THE

AMERICAN NATURALIST,

An Illustrated Magazine

OF

NATURAL HISTORY.

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VOLUME XXVII.

PHILADELPHIA, U. S. A.
THE EDWARDS & DOCKER Co.,
518 AND 520 MINOR STREET.
1893.

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THE

AMERICAN NATURALIST

VOL. XXVII. January, 1893. 313

THE GASES IN LIVING PLANTS.[1]

BY J. C. ARTHUR.[2]

The present state of knowledge regarding the kinds, sources and movement of gases in plants does not constitute a completed volume. There is much yet to be learned, old views are to be corrected, and alleged facts are to be more firmly established. The subject is thoroughly modern, the first writer to give any connected and intelligent account of the behavior of gases in connection with living plants being De Saussure in his brilliant and epoch-making work describing his chemical researches upon vegetation, published in 1804.

THE COURSE OF DISCOVERY UP TO 1865.

The various life functions of plants have been slowly established by first assuming them to be individually the same as those of animals, and from this basis gradually evolving their true nature. The early naturalists saw nothing in plants that suggested lungs or the movement of air, and it was not till the time of Malpighi, 1671, that breathing was supposed to have any part in the plant economy. He saw in the wood vessels, known then and long afterward as spiral vessels, an analogous

[1] Read before the Biological Section of the Amer. Assoc. Adv. Science, in Washington, August, 1891.

[2] D. Sc. Professor of Vegetable Physiology and Pathology, in Purdue University, Indiana.

set of organs to the tracheæ of insects, and therefore believed them to have the same office. His views were accepted by the Englishmen, Grew and Ray, who wrote about the same time, but found no supporters in Germany or France. The views of Malpighi, who in many respects was far in advance of the other botanists of his age, fell into obscurity, insomuch that even the existence of ducts was finally denied.

The subject was not revived until 1715, when Nieuwentyt demonstrated the presence of air in plants by placing sections of stems in water under an air pump. The demonstration was better performed by Christian Wolff, who was a philosophical naturalist of much insight. He placed leaves, wood, and other parts of plants, in water, freed from air, under the air pump, and after seeing the bubbles rise from the tissues as the air was exhausted from the receiver, he allowed the air to re-enter the receiver, and found that the tissues were at once filled with water, and that some kinds were thereby made so heavy as to sink.

In England, a few years afterward (1727), Stephen Hales, the real founder of experimental vegetable physiology, repeated and improved upon the air pump experiments, but used his knowledge to explain the life processes in a different manner from his predecessors. He combined the fact that gases are recovered from plants by dry distillation and fermentation to support a well arranged theory of the use of gases in forming the solid parts of plants. The use of gases by plants was, therefore, according to Hales, a part of the subject of the nutrition of plants.

But this small advance led to no further developments, and was again lost sight of for many years. After nearly half a century, in 1771, Priestley hit upon a discovery which, coming as it did only three years before the discovery of oxygen, and only shortly before the re-organization of chemical theories by Lavoisier and others, proved very fruitful.

Priestley's discovery was simple enough, amounting only to the fact that plants give off oxygen. He tells of his discovery in an interesting way, and I, therefore, quote a few paragraphs

from his communication to the Royal Society, announcing the matter:

"The quantity of air which even a small flame requires to keep it burning is prodigous. It is generally said that an ordinary candle consumes, as it is called, about a gallon in a minute. Considering this amazing consumption of air, by fires of all kinds, volcanoes, etc., it becomes a great object of philosophical inquiry, to ascertain what change is made in the constitution of the air by flame, and to discover what provision there is in Nature for remedying the injury which the atmosphere receives by this means.

"I flatter myself that I have accidentally hit upon a method of restoring air which has been injured by the burning of candles, and that I have discovered at least one of the restoratives which Nature employs for this purpose. It is vegetation. * * * One might have imagined that, since common air is necessary to vegetable as well as to animal life, both plants and animals had affected it in the same manner, and I own I had that expectation when I first put a sprig of mint in a glass jar standing inverted in a vessel of water; but when it had continued growing there for some months, I found that the air would neither extinguish a candle nor was it at all inconvenient to a mouse which I put into it. * * * Finding that candles burn very well in air in which plants had grown a long time, and having had some reason to think that there was something attending vegetation which restored air that had been injured by respiration, I thought it was possible that the same process might also restore the air that had been injured by the burning of candles. Accordingly, on August 17, 1771, I put a sprig of mint into a quantity of air, in which a wax candle had burned out, and found that on August 27 another candle burned perfectly well in it. This experiment I repeated, without the least variation in the event, not less than eight or ten times in the remainder of the summer."

Had Priestley had the good fortune to have set his jar containing green sprigs into direct sunlight, he would have made an additional discovery of almost equal importance. But the world did not wait long till Ingenhousz went over the ground

and discovered (1779) that light was an essential factor in restoring air, and that by the aid of sunlight he could perform in a few hours the experiments which took Priestley five or six days.

In 1800 Senebier added the discovery that plants obtain all their carbon from carbon dioxide, but fell into the error of supposing that part, at least, of this gas was taken up by the plant through its roots, an error that has proved extremely tenacious, existing in our text books to the present day, although repeatedly and fully disproven.

We have now arrived at the time of De Saussure (1804), who, with his superior chemical knowledge, placed the whole subject in excellent shape. He distinguished between carbon assimilation and true respiration. He dealt with the subject quantitatively, and showed that there was a definite relation between the carbon dioxide taken up by the plant and the oxygen evolved by the action of light. He clearly pointed out that the presence of oxygen was as essential to the growth of plants as to animals, the most active parts, such as green leaves, opening flowers, etc., requiring the most, and that this requirement had no relation to the presence of light.

De Saussure also pointed out that while plants receive their supply of carbon dioxide for assimilation, and oxygen for respiration directly from the atmosphere, yet the nitrogen, which is an essential constituent of their organization and by far the most abundant gas in the atmosphere is not utilized by plants in the gaseous form.

Having now established that plants contain gases, that these gases are the same as those of the atmosphere surrounding the plant, that oxygen and carbon dioxide are made use of in their gaseous forms in the life processes of plants, while nitrogen as a gas is not actively connected with the life of plants, and having established these facts with a wealth of accurate experiment and logical deduction that permitted no doubt of the truth, it was left to De Saussure's successors to elaborate the structure which he had so ably built, without being called upon to again readjust the foundations.

It was over thirty years before a work of importance in this line again appeared. In 1837 Dutrochet published his anatomical and physiological memoirs, in which he carefully studied the structure of vegetable organs as well as their functions. He was the first to rightly point out the relations of the cavities in plants to the movement of gases in respiration, that only cells with chlorophyll are able to decompose carbon dioxide, and to distinguish sharply between respiration and assimilation. But although he recognized the essentially different character of the two processes, respiration and assimilation, yet he used the erroneous and absurd nomenclature of the time, and called them nocturnal and diurnal respiration. The weight of his example did much to fix the terms in popular usage, where they still persist, in spite of the protests of every able investigator and writer upon the subject since; and even though the matter was set right by Garreau in 1851, who did admirable work upon plant respiration.

In 1865 appeared the handbook of experimental physiology of plants by Julius Sachs, the founder of the modern school of vegetable physiologists. The work was comprehensive, well balanced, and replete with clear ideas of the theoretical bearing and logical association of the facts.

The author's laboratory at Würzburg, where he shortly became established, has been the school from which most of the great plant physiologists of the present have received instruction and from which all have drawn inspiration. It is sad that its doors should now be darkened by the mists that have gathered over the intellect of its honored director.

In the handbook of Sachs a chapter is devoted to each of the three branches of the subject; aeration, or the movement of gases in the plant; respiration, or the action of atmospheric oxygen; and the effect of light upon vegetation, chiefly in assimilation. Each of the topics is treated in a clear and masterly manner.

Nationality of Discoverers and Writers.

Having traced the growth of knowledge regarding the vital relations of gases to plants up to the time when it was possible

to present the subject in a reasonably complete and well balanced manner, it will be more satisfactory to drop the chronological method of treatment, and to outline the salient features of the subject as they are understood at the present time. Before doing so, however, it will not be unprofitable to glance for a few moments at the parts which the several nations have played in this growth of knowledge, and at the reciprocal influence which has been exerted upon the teachers of those countries.

Science in its highest aspects has always been, as at the present time, the property of the whole world, knowing no political restraint or nationality. The barrier of language, however, has had much to do with retarding the diffusion of knowledge from the original sources of discovery into the text books, which serve as the means of enlightenment for the mass of learners.

The great discoverers and thinkers in our present subject, since the days of Malpighi, an Italian, have been either French, German or English. The Germans, before 1865, made no discoveries of commanding importance, and even their text books barely gave a true account of the subject as known at the time. Link, in 1807, ignored the all-important discoveries of Senebier and De Saussure, the more readily, doubtless, because they were Frenchmen. Twenty-five years afterward De Candolle's general treatise was translated from the French and became one of the most influential text books in Germany.

The chief activity among Englishmen occurred before 1800, and brought forward the names of Hales, Priestley and Ingenhousz. The advanced work was taken up by Frenchmen after 1800, among whom Senebier, De Saussure, Dutrochet and Boussingault are the most conspicuous investigators.

It is chiefly the French botanists, particularly De Candolle and Dutrochet, who have had the most potent and lasting influence upon the popular conceptions of the English regarding vegetable physiology. To them we can also trace a number of errors and omissions which figure in our school text books at the present time. De Candolle was the author of the

imaginary "spongioles" upon the root tips, which still have a sort of backwoods existence in the minds of some persons, although practically eradicated from the text books. He subscribed to the dual respiration of plants by which they gave off oxygen in daylight and carbon dioxide in darkness, which is still taught by certain American text books. In other American text books, which are still standard, a reaction is shown by the suppression of any suitable account of respiration proper, this important subject being referred to only incidentally in a line or two in connection with a short account of the use plants make of stored food material. Thus, in the latest revised edition of Gray's Lessons in Botany, as in the preceding edition, barely three lines are devoted to respiration, while two pages are given to assimilation. This work also teaches the incorrect doctrine[3] that carbon dioxide beside reaching the plant through the surface of the leaves, "is absorbed by the roots of plants, either as dissolved in the water they imbibe, or in the form of gas in the interstices of the soil." In Bessey's Botany, first issued in 1880, respiration is treated in essentially the same brief manner, and it is curious to note that the unusually complete index to the work does not contain the words gas, breathing, or respiration.

The modern phase of plant physiology may be said to have been introduced to English speaking students by the translation of Sach's text book in 1875, and reinforced by the appearance of Goodale's work in 1885, on this side of the Atlantic, and of Vines' work the following year in England. In these works the balance between respiration, assimilation and the physical movement of gases is fairly well maintained. Another work in English, less pretentious, but equally accurate and discriminating with the last mentioned, and antedating them, should be spoken of here, that of Johnson's How Crops Feed, published in 1870. The work was deservedly popular, and is still a source of exact information.

[3]In the discussion which followed the reading of this paper, Prof. Geo. L. Goodale gave Dr. Gray's reasons for retaining his early views. It was Dr. Gray's belief that his statement would prove, upon more extended investigations, to be essentially correct. Prof. W. H. Brewer spoke in further support of the conservative views of Dr. Gray.

(*To be continued.*)

CERTAIN SHELL HEAPS OF THE ST. JOHN'S RIVER, FLORIDA, HITHERTO UNEXPLORED.

BY CLARENCE B. MOORE.

(Continued from November Number, 1892.)

(Second Paper.)

SHELL HEAP THREE MILES NORTH OF PALATKA.[1]

This shell heap on the west bank of the St. John's has been largely washed away by the river, and in addition great quantities of its shells have been "lightered" to Palatka for use upon the streets. It was visited by Wyman and by Le Baron[2] who probably made no excavations, or at all events, did not put them on record. Implements found by them both at this point can be seen at the Peabody Museum, Cambridge.

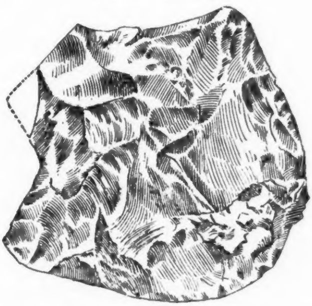
This shell heap is peculiarly rich in relics of stone and of bone, the implements and arrow-heads being rough and of the shell heap type, a much ruder form than the arrow-head or chisel usually found on the surface throughout Florida. It was twice visited by the writer, who found nothing of interest through excavation, but who, in April, 1892, was fortunate enough to be upon the ground at a period when the river was lower than upon any previous occasion on record, leaving bare a large area usually covered by water and rich in relics washed from the section of the shell heap bordering upon the river. A careful search yielded six bone awls; four other implements of bone; two articular portions of the bone of the deer, separated from the shaft by the aid of a cutting instrument; one flat fragment of bone lined along the entire length,

[1]W. W. Calkins (Proceedings of the Davenport Academy of Natural Sciences, Vol. 2, pages 226–227) explored a river mound "north of Palatka," which may be identical with the one under consideration.

[2]Smithsonian Report, 1882, p. 771 et seq.

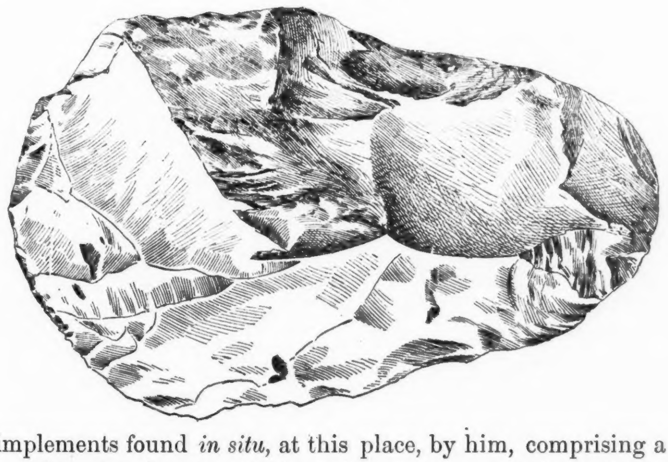
with a hole in the center extending almost through; a small piece of greenstone cut into the form of a pyramid, and six arrowheads, one of quite unusual pattern for the St. John's River, though found in some of the Western States[4] (Fig. 1).

FIG. 1. Size, $\frac{1}{1}$.



Captain Rossignol, formerly in charge of lighters carrying shell to Palatka, presented the writer with a collection of

FIG. 2. Size, $\frac{1}{1}$.



implements found *in situ*, at this place, by him, comprising a number of rude arrow-heads and an implement of chert very

[4]Charles C. Jones, Jr., in "Antiquities of the Southern Indians," describes implements of this character as being broken arrow-heads turned into scrapers. Fig. II, Plate xiv, represents a specimen from Georgia.

roughly wrought on one side, the other being left flat and smooth, recalling the implements of the Moustier Cavern, Dordogne, France (Fig. 2). This shell heap is probably one of the earlier class. A careful search along the entire section of the heap exposed to the action of the river failed to reveal any pottery, and none was met with in digging. Two pieces upon the surface were probably from later Indians. Investigations at this spot, however, were not based upon enough excavations to give a final judgment upon the subject.

TWO SHELL HEAPS ON SALT RUN.

Salt Run makes into Lake George about two miles southwest of where the St. John's leaves the lake. On the right bank, going up, at a distance of about half a mile from the mouth, is a shell deposit some two hunderd yards in length and one hundred yards in breadth, with a height of from four to five feet on the water's edge, increasing to a maximum of ten feet somewhat beyond the middle toward the land. On the same side of Salt Run, about half a mile farther up, is a deposit of shell presenting no irregularities of surface, though varying in depth at different points, owing to unevenness of ground upon which the deposit was made.

EXCAVATION I.

$5\frac{1}{2}$x5x$3\frac{1}{2}$ feet deep; after surface loam no pottery was met with. Fragment of bone awl at a depth of $3\frac{1}{2}$ feet. About three feet down was found, within half a foot of the bottom of

FIG. 3. Size, $\frac{1}{1}$.

the shell deposit, a lance-head of graceful pattern, perfect in every respect; the only lance-head, as far as the writer has been able to learn, ever found at a considerable depth from the surface in any of the shell heaps of the St. John's (Fig. 3). Other excavations yielded nothing of marked interest.

HITCHEN'S CREEK.

At the point where the St. John's River enters Lake George is Volusia Bar. About half a mile south, Hitchen's Creek joins the St. John's on the east side of the river. A short distance above, on the left hand side, going up the creek, are shell heaps and fields under cultivation; in all, about seven acres. A number of excavations yielded the usual bones of edible animals, and showed traces of numerous fire-places at varying depths. In the rear of the dwelling the shell deposit, considerably higher than elsewhere, is closely packed, the shells being crushed to a marked extent and having a large admixture of sandy loam—a "kjökkenmödding." In this deposit, below two feet, no pottery was met with, and the Paludinæ were of small size, in comparison to those of some of the shell heaps. Scattered on the surface were *Paludinæ georgianæ* of large size, mingled with a Paludina previously unknown, *Paludina georgiana,* variety *altior,* Pilsbry.[5] The portion of the shell deposit, toward the swamp, is composed of unbroken shells, mostly of the two varieties of Paludina, of unusually large size and unmixed with sand or loam. Plain pottery is found in great abundance throughout. Water is reached at a depth of two feet. This deposit was probably made by the aborigines living upon the shell ridge adjacent, after the ridge had attained considerable size, since but few of the new variety of Paludina were found in the ridge below the surface and at comparatively little depth.

SWAMP SHELL RIDGE NEAR MORRISON'S CREEK.

About three miles south of Volusia Bar, Morrison's Creek, a "cut-off," divided from the St. John's by an island, enters the

[5]The Nautilus, April, 1892, p. 142, et seq.

river. Below this point, in the swamp, entirely surrounded by water when the river is high, is a ridge of shell running north and south, 350 feet in length, with a maximum breadth of 180 feet. The southern extremity, the lowest portion of the ridge, is from $4\frac{1}{2}$ to 6 feet in height; while the northern end attains a maximum elevation of 11 feet, 10 inches, above the level of the swamp when dry. Two excavations, 8x5 feet, 4 in.x$9\frac{1}{2}$ feet deep and $7\frac{1}{2}$x4x6 feet deep, were made. Two or three bits of rude, plain pottery were met with, but none at a greater depth than two feet from the surface. Just below the surface a human humerus was found, and a human vertebra at a depth of one foot. A fire-place was at the same depth but at a distance from the vertebra, which showed no marks of fire. At a depth of four feet was found a triangular implement of shell; while 4 feet, 8 inches, down, immediately upon a fire-place, were two rude arrow-heads, one with ashes upon it. Animal bones, disconnected, mainly of the alligator, the turtle and the deer, were encountered throughout.

MT. TAYLOR.

This great swamp shell ridge,[6] the highest fresh-water shell deposit on the St. John's River, lies on the east bank, 200 yards (paced) from the water's edge. It is about one mile south of Volusia, and in dry seasons can be reached from the river by wading through the swamp; though access from dry land in the rear, about forty yards distant, is advisable. Under any circumstances, the services of a guide are a necessity. This shell heap is not referred to by Le Baron, nor is it particularly mentioned by Wyman, who could not have failed to describe so remarkable a heap, had it been accorded a visit. On page 44 of his memoir, Fresh Water Shell Mounds of the St. John's River, Florida, "two mounds, right bank, between Lake Dexter and Volusia," are included in the

[6]The thanks of the writer are due to Mr. William Edgar Bird, of Brooklyn, for much information and valuable assistance, and for most cordial permission to prosecute investigations on every portion of his 5000 acres lying between Lake Dexter and Volusia; including the great shell heaps and sand mound of Bluffton, in addition to Mt. Taylor and other shell heaps in the swamp.

list of shell heaps. This somewhat indefinite description would seem to indicate that his knowledge of the existence and location of Mt. Taylor was based upon information derived from others and not personally verified.

Mt. Taylor, standing alone in the swamp, which at high water is covered to a depth of $1\frac{1}{2}$ feet. rises abruptly on every side, the ascent of one portion being at an angle of 40°. The maximum height of the ridge is 27 feet, 2 inches; its length at base 500 feet, with a maximum breadth of base of 175 feet. An almost level plateau on the summit has a length of 266 feet, with a maximum breadth of 80 feet. The mound is overgrown with palmettoes, palmetto scrub, live oaks and cedars. It lies longitudinally east and west, and is composed almost exclusively of Paludinæ of a smaller size than those of many of the later shell heaps. With the exception of a few fragments on the surface, no pottery was found in any portion of the heap, while implements of any description were of infrequent occurrence in the various excavations. As a rule, it may be said, the older the shell heap, the fewer relics are met with, though weapons of stone exist at all depths, even in mounds which contain no pottery, and in others below the level at which fragments of pottery are found.

(To be continued)

LEGENDS OF THE SUMIRO-ACCADIANS OF CHALDEA.

BY ALICE BODINGTON.

In THE AMERICAN NATURALIST for August, 1892, Mr. Wilson puts in a strong plea for the study of prehistoric anthropology, nor can the claims of this science be overrated. But of equal interest in its own line is the study of that earliest civilization of Western Asia, which a few years ago was itself prehistoric, and which has only emerged into the light of day since the deciphering of the Cuneiform inscriptions of Assyria and Chaldea.

Some 5000 years B. C., wandering Turanian tribes[1] settled in the fertile alluvial plains at the mouths of the great rivers, Tigris and Euphrates, round the head of the Persian Gulf. Materials for building, it might be thought, did not exist, save for the giant reeds, fourteen to fifteen feet high, with which the Arabs of that marshy region still construct their huts. But the Sumiro-Accadians,[2] as these Turanian tribes were named, had the faculty possessed by their relations, the Chinese, of taking the first steps in inventions. Out of the mud and clay of their new home they made bricks, at first mere cakes of sund-dried clay; then these cakes were found to gain consistency by mixture with finely chopped straw; finally the clay was kiln-dried and gained a hardness and consistency equal to the best bricks produced now. The kiln-dried bricks were highly valued and were stamped with the name and titles of the king for whose palaces and temples they were to be used. Some bearing the name and title of Gudéa, the *patesi* or priest-king of Sirgulla, have inscriptions of

[1]Chaldea. Story of the Natives. Z. A. Ragozin.

[2]I must disclaim all responsibility for the spelling of proper names, since every authority I have consulted spells the names differently, and no fixed standard seems to have been arrived at. For instance, the spelling is sometimes Shumiro-Akkadian, sometimes Sumiro-Accadian.

a highly archæic character. A statue of unique interest was found at Sirgulla;[3] the head is strikingly Turanian in form and feature and bears a turbaned cap such as may still be seen in Mongolia. No type can be more strikingly unlike that of the Semitic Assyrians who were to be in later times the rulers of Chaldea. This statue, and the bricks with their archæic inscriptions found with it, are considered to be as old as between 4000 and 3000 B. C. A successor to this oldest of known monarchs was Ur-ea, king of Ur, whose date can be approximately arrived at,[4] and whose reign was over before the Elamite Conquest of Chaldea; when Chedorlaomer (Khadar-Lagamar), of Genesis, chapter xiv, marched an army across the desert to attack the rich and populous valleys of Jordan, and carried off Lot, the brother of Abraham, among his captives.

In the materials for holding their bricks together there was also progressive improvement; in the oldest buildings discovered, a sticky red clay or loam was used; then bitumen was substituted, which, being applied hot, adheres so strongly to the bricks that pieces of these are broken off when an attempt is made to take a tragment of the cement. Finally, in the latest Babylonian period, a beautiful white cement made of calcareous earth was used, which has never been surpassed for lightness and strength.

The whole country of Chaldea was absolutely flat; no vestige of natural hillock occurred throughout its whole extent. But the Accadians, whose very name shows their origin as mountaineers, were determined to raise their most important buildings above the inundations, and the wild beasts and noxious insects of the marshy plains. They erected artificial mounds of a size almost incredible. The great mound of Koyun-jik, which represents the palaces of Nineveh[5] itself, covers an area of one hundred acres, and reaches an elevation of ninety-five feet at its highest point. To "heap up such a

[3]Modern Tell-Loh.

[4]Chaldea, p. 214–19.

[5]Though an Assyrian city, Nineveh was built on the Chaldean plan, on a "tell" or mound.

pile of brick and earth would require the united exertions of 10,000 men for twelve years."[6] Then only could the construction of the palaces begin! The mound of Nebbi-Yuma, which has not yet been excavated covers an area of forty acres and is loftier and steeper than its neighbor. The platform of the principal mound of Mugheir (the "Ur of the Chaldees" from which Abraham went forth) is faced with a wall ten feet thick, of red, kiln-dried bricks cemented with bitumen.

The sub-structure of these mounds was made up of rough bricks and rubbish, hence the inherent weakness of the whole structure. The heavy semi-tropical rains falling for weeks at a time soaked through the casing of fine bricks, and the foundation became a mass of yielding mud. The mighty palaces and temples upon which the Assyrian and Chaldean kings lavished all the resources of wealth, all the treasures of art, sank into sand-choked, shapeless heaps. But the treacherous clay could preserve, hidden from the prowling Arabs who roam over this land of once mighty empires, priceless treasures of art and literature. Exquisite alabaster slabs, richly engraved, beautiful enamelled tiles forming colored friezes; the great human-headed bulls whose very discovery made the name of Layard famous; the life-like groups of lions and lionesses; and incomparably more precious than all, the royal libraries formed by the great kings, have been preserved for centuries beneath these unsightly mounds. For the one available substance, clay, formed the almost imperishable material of which the Chaldean and Assyrian "books" were made.

In the great mound of Koyun-jik (Nineveh) Layard found the remains of two sumptuous palaces, the residences of Sennacherib and of his grandson Asshurbanipal, who lived some 650 years B. C., two of the mightiest sovereigns and conquerors of the Eastern World. In Asshurbanipal's palace the explorer found two small chambers, containing a layer, more than a foot in height, of baked clay tablets, covered on both sides with cuneiform writings. Some were still entire, others in fragments. Layard filled many cases with the tablets, broken and unbroken; they were sent to England, and lay

[6] Five Monarchies. Rawlinson, Vol. 1, pp. 317–18.

for years in the British Museum untouched and unnoticed. George Smith, a young archeologist whose devotion to science and untiring industry and patience enabled him to undertake —and to succeed in—an apparently impossible task, determined not only to arrange and engrave the cuneiform texts on the tablets, but to *read* them, and this he succeeded in doing. The result was something astonishing. A series of twelve tablets was brought to light containing an epic poem of the highest antiquity and interest, the one alluded to further on, containing the earliest versions of the great Sun, Moon and Earth myths, of the Deluge, of Bel and the Dragon and of the Creation of the world. Fragments, of course, were missing, and to seek these George Smith was sent (by the generosity of the owners of *The London Daily Telegraph*) to search the Archive Chambers at Koyun-jik, and by inconceivable good fortune, found many of the missing pieces. On his second visit to Chaldea he fell a victim to plague. His last legible words were worthy of a martyr to science. "Not so well. If doctor present I should recover, but he has not come; if fatal, farewell to . . . *My work has been entirely for the science I study.* There is a large field for study in my collection. I intended to work it out, but desire now that my antiquities and notes may be thrown open to all students. I have done my duty thoroughly. I do not fear the change, but desire to live for my family."

Besides the tablets containing the epic poem, two hundred tablets divided into three books were found at Nineveh, fifty of which have been deciphered. The contents of these also are supremely interesting; one book, the oldest, reveals the Shamanitic stage of the Sumiro-Accadian religion; a stage in which many Turanian tribes still remain. It treats of "evil spirits" with which earth, sky and the "abyss" under the earth were conceived to be filled; of sorcerers who could employ the power of the evil spirits for the destruction of mankind, and of magicians who understood incantations and spells capable of driving away these malignant powers,[7] answering to the "black" and "white" magic of the Middle

[7]La Magie et la Divination chez les Chaldeérs. François Lenormant.

Ages. The second book treats of diseases, for which no cure was known but exorcisms, since diseases were conceived to be personal demons. Even so late as three or four hundred years B. C., Greek travelers visiting Babylon beheld sick persons brought out into the streets, where any passer by could enquire as to their malady and suggest a remedy! Even this strange plan was not resorted to till all known forms of incantation had been gone through and proved vain. The third book shows a great advance from this religion of pure terror. Beneficent spirits, gods in fact, were appealed to, especially Una, the Heaven-god; Ea, the great deity of the Earth and Waters; Im, the Storm Wind; Ud, the Sun, and Gibil, Fire. Ea, above all, was beloved by the Sumiro-Accadians for his goodness and trusted for his wisdom. His very name was a terror to evil spirits. But beneficent as he was, Ea was considered too great a deity to be lightly invoked, and in his son Meridug, they found a spirit whose sole office was to mediate between his father and suffering mankind. A whole tablet is devoted to a description of one such intercession, where the "Disease of the Head (insanity) has issued from the Abyss, from the dwelling of the Lord of the Abyss," and has attacked a human being. Then "Meridug has looked on his misery. He has entered the abode of his father, Ea, and has spoken unto him: 'My father, the Disease of the Head has issued from the Abyss. What he must do against it the man knows not. How shall he find healing?'" Ea replies, "My son, how dost thou not know? What should I teach thee? What I know, thou also knowest. But come hither, my son Meridug . . . ." Here follow directions for the cure of the sufferer that the "Disease of the Head may vanish like a phantom of the night."

The conception of conscience was also carried to a high degree among the Sumiro-Accadians. With such insistence and authority did it speak that it was believed to be the voice of an indwelling guardian spirit. Some most beautiful prayers took their origin from this belief; they have been called the Penitential Psalms, from their striking likeness to those psalms in which King David confesses his iniquities and

humbles himself before the Lord. I have space but for a few verses of the Sumiro-Accadian psalm called "The complaint of the repentant heart."

"O my God, my transgressions are very great; very great are my sins. I transgress and know it not. I wander in wrong paths and know it not. The Lord in the wrath of His heart has overwhelmed me with confusion. I lie on the ground and none reaches a hand to me. I cry out and there is none hears me. . . . My God, who knowest the unknown be merciful. . . . How long, O my God? . . . Lord Thou wilt not repulse Thy servant. In the midst of the stormy waters, come to my help, take me by the hand."

Since the key to the cuneiform inscriptions has been discovered, it has been evident that many legends of Genesis are varients of Sumiro-Accadian originals, and that from this source too was drawn the Jewish belief in magic, witchcraft, dreams, supernatural serpents, sacred trees, etc.; whilst the pure Monotheism of later times was fighting hard to establish itself in the hearts and minds of a people, who came from a cradleland of many gods. For in those palmy days of the Yellow Race, when it was at the head of human progress, the Semites are seen as nomad tribes dwelling amongst the Accadians, and in one most noted instance wandering from Ur of the Chaldees, till they finally reached Egypt and the Nile. And the legends, the superstitions, the forms of prayer of Accad are faithfully reflected in the earliest traditions of Israel.

(*To be continued.*)

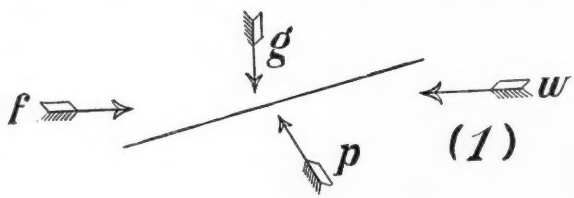
THE FLIGHT OF BIRDS.

By I. Lancaster.

I have been asked what effect the application of soaring methods has upon active wing flight. If soaring goes on so easily where gravity is the motive power, why do not all birds soar?

The soaring activity is not understood when such a question is put, obscurity arising, doubtless, from misconception.

The usual statement of soaring held by everybody, and especially by mechanical authority, is diagrammed in 1, where g represents weight, w, horizontal air resistance, and p,

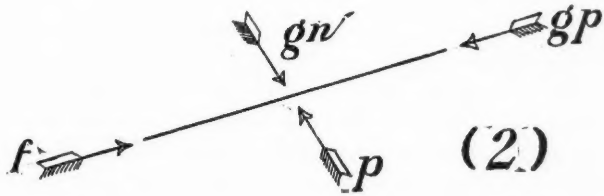


normal pressure. When a horizontal force, f, is applied, of sufficient magnitude to cause p to equal both g and w, the plane moves on the horizontal path of soaring flight. Soaring, or indeed any sort of bird flight, would be impossible thus stated, which may be called the formula method.

The soaring statement presented by nature, is seen in 2, where the horizontal force, f, and the horizontal resistance, w, are stricken out. Vertical g is replaced by gn and gp, while p remains the same in direction but not in magnitude. The pressure plane of air throws g out of vertical, making gn and gp out of it; p is equal to gn; f is equal to gp, and the plane soars; f pushes gp *up* as fast as gn pushes p *down*, producing a horizontal resultant.

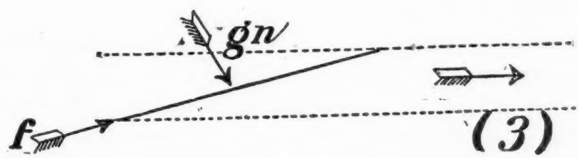
Compare both statements with 3. In either case a prism of air as wide as the distance across the extended wings of the

bird, as thick as the perpendicular distance between the front and rear edges of the wings, and say fifty feet long, is driven



(2)

out of the way in one second of time. This is done, as above stated, in both cases, but the way of doing it is the vital matter. It is driven out by *gn* and not by *f*. Suppose *f* should stop acting. Motion of bird would then be downward on the normal line, in which motion *gn* would do the same work in one second as before. Motion both ways goes on simultaneously, neither having the slightest effect upon the other, for the reason that they are 90° apart, and rectangular forces do not affect each other, the bird moving under each force as if the other were not acting. The way in which the air is driven out is determined by *f*, but *gn* does all the work. The law of



(3)

fluid reactions throws all the air resistance to the bird's motion around, normal to the plane of its wings; *gn* then forces it down, while *f* keeps the bird level.

There is yet a very important point to be understood. In methods sanctioned by mechanical authority weight and air resistance are added in pressure. Both are assumed to be resistance to the soaring force. They should be subtracted,

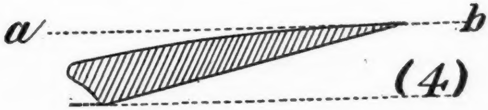
not added. p is a reaction against gn and not a force equal to gn, acting with it against the soaring force. Atmosphere resistance to the bird must be overcome, but weight overcomes it, and is itself used up in the exertion.

I once saw a parody on Jack, the Giant Killer. Jack was set upon simultaneously by two giants, either of which could have demolished him at once. He adroitly set them to fighting each other and then cut off their heads. Nature met with much the same problem. She desired a soaring bird. Two antagonists confronted her, air and weight. She so fashioned a bird as to take advantage of the law of fluid pressure, which set weight upon air resistance, in which contest they were both destroyed. She outdid Hercules in details of destruction. Pressure first cut weight into two unequal parts, then fell upon the greater and transformed it into a stream of escaping air condensation, while the smaller still offered resistance. Then from these condensations, equal to the total normal part, she obtained enough force through wing details to destroy the parallel part, and still have a large surplus. And all this was accomplished by a bird's wing. It seems a pity that such a magnificent piece of work should belong only to fishhawks, carrion crows, and the like.

Further, a single matter must be noticed. By referring to 3, it will be seen that there is a region behind and above the lower surface of the bird, and beneath the front edge, of triangular shape, that is not affected by the air. If the bird had but one motion on the upward slant, any thickness of parts, either of wing or body, would resist. But normal motion confines air collision to the under side, leaving a confused mass of eddies and reacting currents at the upper side. This region of eddies may be filled with solid materials and still not destroy the effect of a mathematical plane devoid of thickness. The front edge must be sharp but the rear edge may be overreached, as in 4, without further resistance. Such shape will move farther in the same time unit normally than a flat shape, while parallel motion is not changed in the slightest degree. The least projection above a b increases resistance.

I have called this region the "neutral zone," for want of a better name. The bodies of all birds are almost entirely confined to this zone.

The original question is now in order. Why do not all birds soar? For many reasons, among which are the following:



(4)

1. A bird may be of such shape that to throw it over to an inclination that gives a parallel factor small enough to be neutralized by the forward thrust would get part of the animal out of the neutral zone. The gray pelican of the Gulf coasts is a case in point; especially when its gullet is full of fish. It must flap to get thrust for its large parallel factor. If its wings were one foot longer on each side, it could doubtless soar continuously, even if its body did encroach on resisting air to some extent.

2. Weight may be too great for surface. In this case condensations escape too readily to be utilized. A wild turkey, prairie-chicken, or pheasant, are examples.

3. Weight may be too little for surface. Here condensation is too weak to give thrust. A species of sea-gull found on the lower Florida peninsula is a good example. In May and June, when food is scarce, they flap continually. In November and December, when food is plenty, they rarely move a wing. They will put into an empty craw their weight in food.

4. Life habits may prevent suitable feather construction. I presume this reason may apply to many small birds.

In the case of bats, the small factor may be entirely neutralized by flapping, as there seems to be at least no surface provision for utilizing the escaping condensations.

Flying squirrels do not sustain themselves.

But in no case of bird flight that I am acquainted with, can it be said that the normal factor is opposed by flapping. That is cancelled by its own work on air. Flapping goes on for the sole purpose of producing parallel motion by either increasing the energy of the condensations, or by a backward push against the air.

It must be borne in mind that the nearer the bird's wings approach horizontal, the less will be the obstructive gravity factor, but on the other hand, the more contracted will be the neutral zone. The moment this zone is encroached upon, more is lost in resistance of air, than is gained by lessening the small factor.

In experimenting, I never pay the least attention to what I have called the "soaring force," meaning thereby the force required to push the plane to the resultant, after the small factor is neutralized. I have never used scales delicate enough to measure this force. The moment the small factor is out of the way, the plane runs to the front to the limit of its freedom.

There is the narrowest possible margin between active and fixed wing flight. The only group of white pelicans I ever met with, eight in number, moved through the air in alternate flapping and gliding motion. Once only, I found them facing a southwester on fixed wings. They rested in the gale as firmly as if fastened to a rigid support. I had been observing them daily for five months and was rewarded by this very unusual exhibition. I shot one of them and found its gullet and intestines full of fish, and it could only spread one square foot of surface to each five pounds of weight, the greatest contrast of surface to weight I ever found.

The entire subject of bird flight has been persistently misconceived. It must be recast in toto to rescue it from the mass of delusion that involves it. To speak of erroneous details is labor lost. It is *all* erroneous. There is no stress in the entire activity, either in direction or magnitude, where stresses are supposed to be. When it is seen that from eleven-twelfths to seventeen-eighteenths, approximately, of total weight is employed in overcoming total air resistance to the

bird's motion, it is easily conceivable that the animal may overcome the remaining resistance without the necessity of estimating the muscular exertion of a creature weighing eight ounces in terms of horse power.

EDITORIALS.

EDITORS, E. D. COPE, AND J. S. KINGSLEY.

—AT the October meeting of the American Humane Association, held in Philadelphia, a resolution was passed of a very dangerous nature. It urged upon the Legislature of every State in the Union the enactment of laws which shall prohibit, under severe penalty, the repetition of painful experiments upon animals for the purpose of teaching or demonstrating well-known and accepted facts. The danger lies not in the intent, but in the fact that incompetent persons will feel it their duty to say that this experiment is painful, that another is unnecessary; and further, it strikes a deadly blow at all future increase of knowledge. An investigator in physiology can only be trained by the laboratory method. He cannot read the accounts of previous work and, with no further preparation, proceed at once to the solution of new problems. He must, rather, test his powers of experimentation by this very repetition which the proposed law prohibits. He must demonstrate for himself "well-known and accepted facts," and until he is able to bring his results into full accord with those facts he is incompetent to enter untrodden fields where he is without checks upon the accuracy of his results.

That the proposed legislation is not so vicious as some, which, fortunately, has been rare in the United States, is a matter for which we should be thankful; but, on the other hand, it would place a dangerous tool in the hands of such fanatics and unqualified persons as commonly occupy important positions in connection with the societies for the prevention of cruelty to animals. The writer has a somewhat extensive acquaintance with the physiological investigators of both Europe and America, and he knows them to be as a class humane persons unwilling to inflict unnecessary suffering upon any animal, and at the same time fully as competent to judge of the necessity of any experiment as the persons whom the proposed legislation would put in the position of prosecutors and judges.

—LIEUTENANT PEARY has obtained leave of absence from the Secretary of the Navy for the purpose of further prosecution of Arctic explorations. He proposes to establish himself at a point on the northern coast of Greenland already visited by him as a base for

explorations northward. He expects to travel over the ice which covers the ocean, toward, and if circumstances permit, to the pole. It will be a fortunate circumstance, and one conducive to the success of the expedition, if land shall be found to the north of Greenland. This, Lieutenant Peary suspects, may be the fact. Transportation will be thus more easy and less dangerous, and much of interest to science may be expected to result. The determination of the geologic and paleontologic features of the region is of first-class importance to world-history, and much important evidence will be contributed toward the solution of some at present obscure problems.

—THE numbers of THE AMERICAN NATURALIST for 1892 were issued at the following dates: January, March 26; February, March 31; March, April 25; April, April 29; May, May 1; and all subsequent numbers on the first of the month named on the cover and pages.

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RECENT LITERATURE.

The Apodidæ.[1]—This, one of the latest of the "Nature Series," is not up to its predecessors either in accuracy of statement or suggestiveness of matter. The author, starting off with the intention of working up the comparative anatomy of this family of phyllopod crustacea, has been led to regard them as all-important in phylogenetic speculations, but, unfortunately, the good points of his volume are not original, while the original portions cannot be praised. Thus the central position of the Phyllopods in the Crustacean branch was recognized long ago, while the comparison of the foot of the Apus with the parapodum of a Polychæte worm was made long before Bernard entered the field of zoology. On the other hand the special studies of Mr. Bernard have led him to regard the differences between the annelids and Apus as of extremely minor importance. All you have to do, says he in effect, is to bend the anterior end of a carnivorous annelid back upon itself to produce this portion of Apus, and the thing is done. Resemblances are magnified and differences are minimized or ignored, and presto! Apus is the all-important arthropod. The name of Macmillan & Co. is so uniformly associated with only first-class works that we were surprised to see it on the present volume.

Darwin, and After Darwin; I, The Darwinian Theory, by GEORGE JOHN ROMANES.[2]—Romanes has devoted the best years of his life to the defence of the evolutionary faith and to making himself acquainted with, advocating, and extending Darwin's ideas. The present work consists of two volumes, viz., "The Darwinian Theory," and "Post-Darwinian Questions." The latter, soon to be issued, is to treat of heredity, utility, isolation, etc., which have become prominent since the death of Darwin. The former is a systematic exposition of the Darwinism of Darwin. It gives a résumé of the evidence, as it is known at present from classification, Morphology, Embryology, Paleontology, and Geographical Distribution, and includes a full discussion of the Theories of Natural and of Sexual Selection. It is a neat volume of 460 pages, fully

[1]The Apodidæ. A morphological study, by Henry Meyners Bernard. London and New York. Macmillan & Co., 1892.

[2]Chicago. The Open Court Publishing Company, 1892.

illustrated with new figures that largely increase its value. It is the best single volume on the general subject that has appeared since Darwin's time, and it is doubtless destined to be for years to come the one book to which general readers will turn for a concise statement of his ideas.

The principle of continuity makes antecedently probable the theory of organic evolution. The probability is strengthened by the fact that a natural classification of organic beings seems with the advance of knowledge more and more evident. The evidence from Morphology in the present volume is confined largely to a discussion of rudimentary structures, and especially such as are found in the human body. Muscles of the external ear, panniculus carnosus, feet, hands, tail, vermiform appendix of the cæcum, ear, hair, teeth, perforation of the humerus and flattening of the tibia are all treated. In this connection Dr. Louis Robinson's recent interesting observations on the grasping power of the infant's hand are reported. In discussing Embryology, considerable space is devoted to the phenomena of fertilization and karyokinesis, since the author believes the great similarity in these highly complex and specialized processes, shown throughout the animal and vegetable kingdoms, to be indicative of organic continuity, and hence evidence of the highest importance. The testimony afforded by connecting links, which has accumulated mainly since Darwin first published, forms an interesting section, made more interesting by good figures. Geographical Distribution is mainly a summary of Wallace's observations.

The evidence for and against the theory of Natural Selection is fully and fairly given. Romanes believes this principle to be not the sole, but the most important, factor of organic evolution. The main general arguments in favor of the theory are three, viz., its inherent necessity, the facts of heredity, variation, and struggle for existence being excepted; the fact that among all the millions of structures and instincts, each is developed for the benefit of its own species, and in not a single case for the exclusive benefit of another species; also the facts of domestication. Protective coloring, warning coloring and mimicry afford strong evidence. The theory of Natural Selection is often misunderstood, even by its advocates, notably by Wallace. Certain apparently strong objections to it are capable of being answered, and this Romanes proceeds to do, discussing the presence of similar organs in widely different groups (Mivart's instance of the eyes of the cuttlefish and of vertebrates), and the preservation of the first beginnings of structures (the Duke of Argyll's "Prophetic Germs"),

where the principle of correlation must play so important a part. The electric organ in the tail of the skate is a formidable case, which our present knowledge is not able satisfactorily to dispose of. In the last chapter Mr. Wallace's objections to Darwin's theory of Sexual Selection are replied to. The relations of the Darwinian doctrine to adaptation and beauty in organic nature are discussed in brief, and finally its relations to the fundamentals of religion.—F. S. LEE.

The Diseases of Personality, by TH. RIBOT.[3]—The new Psychology is under a great debt to Ribot for his studies of nervous diseases. In this last volume he bases personality as the highest form of psychic individuality upon the organic sense. All the bodily organs are constantly sending into the central nervous system impulses that give rise to sensations. These organic sensations are relatively more prominent in the lower animals, because there they are not, as they are higher in the scale, covered up by desires, passions, perceptions and ideas. Everywhere, however, they form the physical basis of personality. The author analyzes the organic, emotional and intellectual conditions and disorders of personality. The discussions include the meaning of "individual" in various forms of animal life; the personality of twins and double monsters; the rôle of memory; transformations brought about by hallucinations and by ideas; the phenomena of the dissolution of personality in cases of progressive dementia. A convenient, if not entirely comprehensive, classification of the diseases mentioned is that its three categories, viz., *alienation* (where the changed person is either entirely ignorant of his former self or regards it objectively), *alternation* (ordinary cases of double consciousness), and *substitution* (where the individual takes on a new character, yet is conscious of his former one, as where he now believes himself a king, although he remembers that he was formerly a poor man).

It is to be hoped that the same publishers will issue in the same neat form the author's works on the diseases of memory and of the will.

F. S. LEE.

[3]Authorized translation, Chicago. The Open Court Publishing Co. pp. 157.

General Notes.

GEOLOGY AND PALEONTOLOGY.

On the Formation of Oolite.—Dr. A. Rothpletz has proposed a theory of the formation of oölite, which is as interesting as it is novel. He noticed on the shores of Great Salt Lake, Utah, snow-white and silver-gray calcareous corpuscles in great numbers. They form a large part of the beach sand, and where they lie in the water they are partly covered with a bluish-green alga-mass. On examination the algoid bodies proved to be colonies of cells of the lime secreting algæ, Glœocapsa and Glœothece. By a series of experiments Dr. Rothpletz satisfied himself that the calcareous bodies secreted by the plants and the calcareous bodies which compose the beach sand are identical. Pursuing his researches, the author investigated the oölites from the strand of the Red Sea, and found that although slightly differing in structure, these oölites originate similarly to those of Salt Lake; that is, from lime secreting algæ.

In studying fossil forms Dr. Rothpletz has found in a gray limestone from the Lias of the Vilser Alps, and in the great oölite structure of the Wettersteinkalk structures analogous to the calcareous bodies from Salt Lake. Also the structure of certain calcareous oölites investigated by Wethered, and more recently by Bleicher (May, 1892), closely resembles that of the Red Sea oölite. In view of these facts, Dr. Rothpletz is inclined to believe that at least the majority of the marine calcareous oölites with regular zonal and radial structures are of plant origin; the product of microscopically small algæ of very low rank, capable of secreting lime.—From *Botanisches Centralblatt.* Translated by F. W. Cragin for the *American Geologist,* Nov., 1892.

Geology of Northeastern Alabama.[4]—Mr. Hayes' report covers the topography, drainage, stratigraphy and structure of Northeastern Alabama and adjacent portions of Georgia and Tennessee. It is intended as a basis for the economic geology of that region, and is, therefore, general rather than special and detailed. The rocks of the

[4]Report on Geology of Northeastern Alabama and adjacent portions of Georgia and Tennessee. Bulletin No. 4, Geological Survey of Alabama. By C. Willard Hayes, Assistant Geologist U. S. Geol. Surv., 1892.

area under consideration are all Paleozoic, and include representatives of all the larger subdivisions of that system. A columnar section of the strata exposed east of Browntown Valley gives the Cambrian rocks an average thickness of 7550 feet; the Silurian, 5935 feet; the Devonian, 180 feet; and the Carboniferous, 2175 feet. The formation names are all new, being purely geographic and local. It is questionable if the making of new names is necessary in regions contiguous to those with similar formations whose names have been generally adopted. The reason advanced, "to avoid all remote correlations," does not seem sufficient to warrant such innovations.

The report is accompanied by an excellent Geological map which shows a structure section through Northeastern Alabama.

The Mesosauria of South Africa.—Paleontologists are indebted to Prof. H. G. Seeley for a detailed description of the Mesosauria of South Africa, and an exact statement of the relations of Mesosaurus with Stereosternum.

For many years the genus Mesosaurus has been evidenced by a single fossil from Griqualand, South Africa, described by Gervais in 1865 under the name *Mesosaurus tenuidens.* In 1878 four specimens from the shale at the margin of the Kimberley Diamond field were obtained by Mr. G. H. Lee, and deposited in the British Museum. They show that Mesosaurus was a long-tailed reptile, with hind limbs well developed. Mr. Seeley found it impossible to refer the Kimberley specimens to *M. tenuidens*, and described them under the name *M. pleurogaster*. The well-developed abdominal ribs, formed of flattened plates, give this species its most distinctive feature.

A second specimen of *M. tenuidens* found in the district of Albania by David Arnold, preserved in the Cape Town Museum, shows the ventral aspect of the anterior part of the skeleton. There are some differences between this specimen and the type, but Mr. Seeley does not consider them important enough to prove specific distinction.

Another specimen of the same genus, from near Burghersdorf, is in the Albany Museum at Grahamstown. It shows the dorsal aspect of dorsal vertebræ and ribs. It indicates a new species, but there is no character available for its definition except that of relatively stout ribs.

In discussing the relations of Mesosaurus with Stereosternum, Mr. Seeley refers to *Stereosternum tumidum* from Brazil, described by Cope in 1886, and figures the shoulder girdle of that species to show a pair of wide, thin, crescentic bones in advance of the

shoulder girdle. In regard to these bones Mr. Seeley says: "If the transverse expansion seen in the Paris type of *Mesosaurus* is the same bone, its form is imperfect, but it is in the same position as the lateral crescentic bone of *Stereosternum.* There is nothing in the Cape Town *Mesosaurus* which corresponds in form with these bones in *Stereosternum,* and the shoulder girdle in the two types seems to be unlike, because the coracoids in the Brazilian genus met (as shown by the thickened margin) in the median line, while in *Mesosaurus* there seems to have been a squamous overlap as in Monotreme mammals, and as the coracoid cartilages overlap in *Triton* and *Salamandra.* This condition, so far as I am aware, is not otherwise suggested by remains of fossil reptiles. There is also a possible resemblance to Salamanders in the fact that the scapula and coracoid are not separable, though the Cape Town *Mesosaurus* appears to indicate a suture.

These African Sauromorpha closely resemble some genera from the Trias of Europe in general form and characters of the humerus. This leads Mr. Seeley to present, for the present, the following classification of a small group to which he gives the name "Mesosauria:"

MESOSAURIA.

General Characters.—Palate closed in the median line, teeth slender, prehensile; cervical ribs with a single articulation, dorsal ribs articulated to the anterior face of the neural arch. The shoulder-girdle formed of scapular and clavicular arches. Humerus expanded distally with an ent-epicondylar foramen. Digits terminating in claws.

Division I. Proganosauria.

Articular faces of centrum conically cupped, coracoid and scapula anchylosed, a larg· clavicle (or separate episcapulæ), a sacrum of four vertebræ, a foramen in the pubis, five bones in the distal row of the tarsus, neck short, tail long. South Africa, South America.

Division II. Neusticosauria.

Articular faces of centrum flat, coracoid and scapula separate, clavicles relatively small (no separate episcapula), sacrum unknown, a notch instead of a foramen in the pubis, neck long, tail short. Europe.

This order is an important diagnostic type of its horizon, and all additional knowledge respecting it is welcome.

Quarterly Jour. Geol. Soc., Nov., 1892.

Kansas Pterodactyls.—The wealth of material in the museum of the Kansas University affords Prof. Williston the opportunity to compare the genera Nyctodactylus, Pterodactylus and Pteranodon, with the following result:

"It seems very probable that the genus Nyctodactylus has no teeth in its jaws; it agrees in *every other respect* with the genus Pterodactylus, so far as known. Now, in not a few species of Pterodactylus the teeth are confined to the anterior end of the jaws, and their entire absence, unaccompanied by other structural differences, will hardly constitute an order, or even a family.

"Pteranodon differs from Pterodactylus, so far as that genus is known, in the united coracoscapulæ and pubes, both of which characters are found in Rhamphorhynchus.

"The sole family characters remaining then, for Pteranodon, are absence of teeth, a supra-occipital crest, and the articulation of the upper end of the scapula."

Prof. Williston, therefore, proposes the following classification:

Order Pterosauria.

Family Pterodactylidæ; sub-families, Pteranodontinæ, Pterodactylinæ.

Family Rhamphorhynchidæ.

Family Ornithocheiridæ.—Kansas University Quarterly, July, 1892.

Geological News, General.—Prof. S. W. Williston considers the practice of American text-books in Geology in introducing generic names of characteristic fossils as the names of the geological horizons whence they come as very reprehensible. Leconte's Elements contains a long list of such names that have long been out of use by paleontologists.—Kansas Univ. Quart., July, 1892.——According to T. Mellard Reade, marine sands are rounded and highly polished, while non-marine but purely glacial sands are invariably angular.—*Geological Magazine*, Oct., 1892.——M. Boule calls attention to some well-preserved remains of *Elephas meridionalis* found in the volcanic terranes of Senèze (Haute-Loire). They resemble *E. meridionalis* of the English Crag. This fossil confirms M. Boule's previous statement that while some of the volcanoes of the valley of the Allier (Coupet and Chilhas) were active during the middle Pliocene, others, like Senèze, are contemporary with *E. meridionalis*, and are therefore more recent.—*Revue Scientifique*, Nov., 1892.

Paleozoic.—A new form of the rare group Agelacrinitidæ has been found in the lower carboniferous limestone of Cumberland,

England. The fossil is described and figured in the Quart. Jour. Geol. Soc. May, 1892, under the name *Lepidodiscus milleri*, by G. Sharman and E. T. Newton.——Mr. H. G. Seeley describes a new reptile from Welte Vreden, Cape Colony, *Eunotosaurus africanus.* The dorsal vertebræ in form and number suggest the Chelonian type, but the specimen affords no proof that the whole of the dorsal vertebræ are preserved. Every character preserved differs from those of South African fossils hitherto known, with the exception of the pubis, which suggests that the specimen is referable to the Mesosauria in a division distinct from the Proganosauria.—Quart. Jour. Geol. Soc., Nov., 1892.——Eleven new species of Lower Silurian Ostracoda referable to the two genera Leperditia and Schmidtella are described and figured by E. O. Ulrich in the Amer. Geol., Nov., 1892.

Mesozoic.—Mr. Arthur Hollick calls attention to some fossil molluscs found at Tottenville and Arrochar, Long Island. Prof. Whitman has determined them to be marine cretaceous species. These, in connection with cretaceous plants found in the same locality, establishes the cretaceous strata which have hitherto been assumed to extend along the southern and western shores of Long Island.—Trans. New York Acad. Sci., 1892, p. 96.——A new Mosasaur, *Clidastes westii*, is described by Mr. Williston. The fossil was found in the uppermost of the Niobrara beds, and consists of a complete lower jaw, quadrate, portions of the skull, the larger part of the vertebral column, and the incomplete hind and fore paddle. It is estimated that the animal in life measured seventeen and one-half feet.—Kansas Univ. Quart., July, 1892.——Mr. Uhler's observations show three structural units in the Tuscaloosa formation instead of the one insisted upon by McGee and Darton. His division is as follows: 1 The Potomac formation proper laid down on the broken border of the crystalline rocks and capped by the variegated clay. 2 The Albirupean formation, which includes the series of clays, sands and cobble-stone deposits resting between the variegated clay and the base of the Severn formation. 3 Alternate clay sands resting upon the irregular and eroded surface of the white clay or sand of the preceding group.—Trans. Maryland Acad. Sci., 1892.

Cenozoic.—The collection of fossil marsupials at Queensland includes a fine series of mandibles of *Phascolomys mitchellii*, which support Mr. De Vis in making this a distinct species from *P. platyrhinus.* —Proceeds. Linn. Soc. N. S. W., 1891.——Two species, *Laganum*

decagonale and *Cassidulus florescens*, have been added by Mr. Gregory to the Australian fossil Echinoidea. The papers recently published by Cotteau, Tate, Bittner, and Gregory on Australian Cenozoic Echinoids, show that the fauna in question is Eocene and Oligocene instead of Miocene, and that it is remarkably rich and varied in genera.—*Geol. Mag.*, Oct., 1892.——A collection of mammalian bones from Mongolia reported on by Lydekker are of interest since they carry the Chinese mammalian fauna to a more northern district than has hitherto been known, and they indicate two Indian Siwalik species not previously recorded from Chinese territory, viz., *Hyæna macrostoma* and *Equus sivalensis*.—Records Geol. Surv. India, Vol. xxiv.

MINERALOGY AND PETROGRAPHY.[1]

The Origin and Classification of Igneous Rocks.—Mr. Iddings[2] has recently published at length the data upon which are based his conclusions concerning the causes of the different structures exhibited by the igneous rocks of Electric Peak and Sepulchre Mountain and of their varied mineral composition. The main results reached by this study have already been noticed in these pages.[3] It may be well again to call attention to the fact that in this region the different conditions attending the final consolidation of the ejected and of the intruded magmas affected not only their crystalline structure, but also their essential mineral composition; consequently, the molecules in a chemically homogenous fluid magma combine in various ways and form quite different associations of silicate minerals, producing mineralogically different rocks. For instance, biotite is an essential constituent of even the most basic of the intrusive rocks, while in the effusive phases it is rarely found in rocks containing less than 61% of SiO_2. Again, quartz is common in the coarser grained varieties of the former and is absent from those of the latter. Therefore, it is more proper to consider intrusive and effusive rocks that have a like chemical composition as *corresponding* or *equivalent* rocks, than those forms of the two series that have similar mineral compositions. The classification of igneous rocks should recognize the close dependence of structure and mineralogical composition upon geological relations. But, since the structure is the best exponent of these relations, structure should form the basis of this classification. Though giving most of his attention to the general subject of the relation existing between the structure and the geological position of the rocks of the area described, the author devotes a portion of his article to illustrating the intergrowths of hypersthene, pyroxene and hornblende that occur so plentifully developed in the rocks of the region.——In a second paper the same author[4] attacks the great problem of the origin of igneous rocks. He introduces the subject by outlining the growth of the theory first enunciated by Scrope, that the varieties of igneous rocks are the result

[1]Edited by Dr. W. S. Bayley, Colby University, Waterville, Maine.
[2]Twelfth Ann. Rep. Director U. S. Geol. Survey, Washington, 1892, p. 569.
[3]Cf. AMERICAN NATURALIST, April, 1890, p. 360.
[4]The Origin of Igneous Rocks. Bull. Philos. Soc. Wash., xii, 1892, p. 89.

of the differentiation of a homogeneous magma. Scrope's notion was a crude one, but it has been built upon little by little until it has, in the hands of Mr. Iddings, been placed upon a footing secure enough to warrant its being thoroughly tested by observation and experimentation. The author points out the evidences of the close relationships exhibited by the rocks emanating from a volcanic center and their differences from similar groups from other centers, and then takes up the question of the differentiation of molten magmas. He brings forward geological and chemical evidences of the fact of differentiation, and explains the act upon Soret's principle that in a solution whose parts are at different temperatures there will be a concentration of the salt in the colder parts. Lagorio has shown that rock magmas are solutions, and Iddings believes they are solutions of the chemical elements or of their oxides. Consequently, after differentiation has taken place and cooling sets in, different minerals are formed according to laws that depend upon the proportions of the oxides occurring in the differentiated portions. This is apparently contradictory to the view of Rosenbusch,[5] who regards rocks as having originated in the differentiation of a magma, but of a magma which is a solution of *silicate salts* in a *silicate solvent*. As a result of the condition of affairs suggested by Iddings the first eruption from a volcanic center would naturally possess a composition intermediate between those of succeeding eruptions. As a fact the author states that the sequence is usually a rock of intermediate composition, followed by less siliceous and more siliceous ones, to those very basic and very acid. The last eruptions are of very exceptional character. These will occur in small quantity only, and will be first eroded from the surface. Consequently these forms will be found principally in dykes. They are the forms to which Rosenbusch has given the group name "Ganggesteine." These rocks, according to Iddings, have their equivalents among volcanic flows, but the association of minerals in them is different. It is simply their structure, therefore, that characterizes the dyke rocks. They have originated in the same manner as have other eruptives, and consequently are not essentially different from them. The author's views are developed carefully and at considerable length. They will undoubtedly serve to turn the attention of petrographers to a subject that has lain neglected long enough—the comparative study of rocks of single geological provinces. The paper will well repay very careful reading by all petrographers and theoretical geologists, who should be

[5]American Naturalist, Nov., 1890, p. 1071.

glad to know that it is on sale by the Philosophical Society of Washington, from whose secretary it may be purchased for $1.

The Novaculites of Arkansas.—In his excellent discussion of the novaculites of Arkansas, Griswold[6] describes most of these rocks as consisting of very tiny irregular grains of quartz with occasional specks of carbonaceous matter. Originally the rock contained also well crystallized rhombohedra of calcite, traces of which are sometimes seen in the sections. Generally, however, the calcite has entirely disappeared, and its place is now occupied by a rhombic cavity, around which the quartz grains are packed as though they had been shoved about by the crystallizing carbonate. The good cutting qualities of Arkansas whetstones are thought to be due to the presence of these cavities. The purity of the Hot Springs novaculite is shown by an analysis that yielded:

SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	Na_2O	Loss	Total
99.45	.26		.12	tr.	.19	.54	.06=	100.62

According to the author the rocks were first deposited as a mud or ooze, in which calcite crystallized. They were then consolidated by simple pressure, and finally, after upturning and erosion, they were supplied with a small quantity of secondary silica.

Petrographical News.—Osann[7] has discovered that the mineral heretofore regarded as sodalite in the Montreal eleolite-syenite is nosean, as it contains 5-6% of SO_4, and very little calcium. It is quite abundant in the rock, and is included as idiomorphic grains in its garnets. A microscopical test proposed by the author for distinguishing between nosean and sodalite is as follows: Moisten slide with dilute acetic acid to which a little barium-chloride has been added, and allow to stand in an atmosphere of the acid. Sodalite remains transparent, while nosean is covered with an opaque coating of barium sulphate.

The coloring matter of the black limestone of the Pyrenees is shown by Jannetaz[8] to be carbon, probably in the form of anthracite.

The new catalogue of geology and petrography issued by Ward's Natural Science Establishment, of Rochester, N. Y., deserves mention

[6]Ann. Rep. Geol. Survey of Ark. for 1890, Vol. iii, pp. 122–168.

[7]Neues Jahrb. f. Min., etc., 1892, i, p. 222.

[8]Bull. Soc. Franç d. Min., xv, 1892, p. 101.

in these notes because of the full list of rock names contained in it. The principal rock types are defined, and under each are given the technical names of all its varieties. It is further interesting as an indication of the growing importance of lithology in this country, since it is quite evident that Prof. Ward would not find it advisable to keep in stock such a large quantity of rock material were the demands for it rare. The catalogue may well serve the geologist as a table of petrographical synonyms.

A New Occurrence of Ptilolite.—A new occurrence of *ptilolite* has been discovered by Cross and Eakins[9] in Custer County, Col., about three miles southeast of Silver Creek, in the vesicles of a dull green devitrified pitchstone. The mineral is in very slender needles that are optically negative. An analysis made on very carefully selected material gave:

SiO_2	Al_2O_3	CaO	K_2O	Na_2O	H_2O	Total
67.83	11.44	3.30	.64	2.63	13.44=	99.28,

which is equivalent to $R_7\,Al_2\,Si_{10}\,O_{24}+6\frac{2}{3}\,H_2O$, a formula identical with that determined for mordenite by Pirsson.[10] Clarke[11] regards a part of the water in each mineral as basic, and believes that mordenite, the ptilolite from Silver Creek and the original ptilolite (which is poor in Na_2O) are mixtures of the salts. $Al_2\,(Si_2O_5)_5\,Ca\,H_2.\,3Aq$, $Al_2\,(Si_2O_5)_5\,Ca\,H_2.\,6Aq$, $Al_2\,(Si_2O_5)_5\,Na_2\,H_2.\,6Aq$ and $Al_2\,(Si_2O_5)_5\,K_2\,H_2.\,6Aq$.

Mineralogical News.—*Polybasite* and *tennantite* are reported by Penfield and Pearce[12] from the Mollie Gibson Mine in Aspen, Col. The former is the ore of the mine. It occurs massive, often associated with barite and siderite. It is of a grayish-black color, and has disseminated through it patches of the lighter tennantite. Analyses, corrected for impurities, follow:

	S	As	Sb	Aq	Pb	Cu	Zn	Fe
Polybasite.....	18.13	7.01	.30	56.90		14.85	2.81	
Tennantite...	25.04	17.18	.13	13.65	.86	35.72	6.90	.42

Crystals of both minerals are known to occur in several of the Colorado mines, though they have not yet been described.

9 Amer. Jour. Sci., August, 1892, p. 96.
10 Cf. AMERICAN NATURALIST, 1891, p. 372.
11 Amer. Jour. Sci., August, 1892, p. 101.
12 Amer. Jour. Sci., July, 1892, p. 15.

The *cerussite* from Pacaudière, near Roanne, Loire, France, is stated by Gonnard[13] to be associated with copper, silver and lead compounds, pyrite, limonite, quartz and calcite. Its simple crystals present a large variety of planes. Twinned crystals are common, and trillings are known. A description of the several types is given by the author. For sixty years past the same mineral has been known to occur at the argentiferous galena mines of Pontgibaud Puy-de-Dôme, but the fact has not been noted in the treatises on Systematic Mineralogy. All the crystals seem to have been formed at the expense of galena and bournonite by the action of CO_2 from the neighboring volcanic vents. The habit of its crystals is well described by Gonnard[14].

Morenosite [$(Ni\ Mg)\ SO_4 + 7H_2O$] in green stalactites from the foot of the Breithorn in Zermatt, yielded the same mineralogist[15] the figures $SO_3 = 28.7$; $NiO = 18.5$; $MgO = 6.5$; $H_2O = 46.5$. A single fragment of an ochre-yellow mineral from New Caledonia is a silicate of nickel, magnesium and iron:

SiO_2	Fe_2O_3	Al_2O_3	NiO	MgO	H_2O	Total
33.0	18.5	1.5	26.3	8.0	14.0 =	101.3

Frossard[16] substantiates the statement of Mallard that the black garnet *pyreneite* is a grossularite and not a melanite as reported by Raymond. Its density varies between 3.375 and 3.53.

Vesuvianite is reported by Pisani[17] from Settino in the Rhetian Alps. Its analysis gave:

SiO_2	Al_2O_3	FeO	CaO	MgO	MnO	Loss	Total
39.0	14.3	1.8	37.4	6.7	tr.	.9 =	100.1

The supposed *martite* crystals in the rock of Cuzeau, Mont Doré, are tabular hematites cemented into octahedra by magnesio-ferrite, as determined by Lacroix.[18]

In the basic clays of Condorcet near Nyons, Drôme, France, are boulders of siliceous limestone, with cavities whose walls are lined with bi-pyramidal *quartz* crystals, transparent *celestite*, *dolomite* and *calcite*. The quartz and celestite both contain rare planes beautifully developed.[19]

[13]Bull. Soc. Franç d. Min., xv, 1892, p. 35.
[14]Ib., xv, p. 41.
[15]Ib., xv, p. —.
[16]Ib., xv, p. 58.
[17]Ib., xv, p. 47.
[18]Ib., xv, p. 11.
[19]Ib., xv, p. 27.

Mineral Syntheses.—Bourgeois and Traube[20] having failed to produce *carbonates of the magnesium* group of elements by the reaction of urea, water and metallic chlorides on each other at 130° in sealed tubes, have made another attempt at their synthesis by substituting potassium cyanate for the urea. The attempt proved successful, needles of *aragonite* and rhombohedra of *dolomite* and *magnesite* having been produced under the conditions mentioned, when the chloride used was a mixture of the magnesium and calcium salts in molecular proportions.

By the slow action of dilute solutions of copper chloride upon freshly precipitated lead hydroxide at ordinary temperatures there is produced a blue powder consisting of octahedra and cubes of *percylite*, with which are associated quadruple twins of a colorless mineral supposed by C. Friedel[21] to be *phosgenite.*

Crocoite has been obtained by Ludeking[22] upon allowing a strong solution of caustic potash to stand for some time in contact with lead chromate in the presence of a little potassium chromate. By using a large excess of very strong caustic potash *phœnicochroite forms.* The crystallization of the latter substance is due to the abstraction of the solvent by the carbon-dioxide of the air, and of the former by a further reaction between the caustic potash and chromic acid.

New Minerals.—*Penfieldite.*—This mineral, discovered by Prof. Genth[23] on the slags from Laurion, Greece, is evidently produced by the action of sea water upon the materials of the slag. It is usually in the form of hexagonal prisms with basal planes, or in prisms tapered by pyramids. The color is white and the lustre vitreous to greasy. An analysis of the tapering crystals gave: Cl = 18.55, Pb = 78.25, O = ——, indicating the formula $PbO.2PbCl_2$.

Brazilite is a new tantalo-niobate from the iron mine Jacupiranga, in S. São Paulo, Brazil. Hussak[24] describes it as occurring in the magnetite-pyroxene rock called by Derby jacupirangite. It was separated by washing the decomposed residue of this rock in a miner's pan, and has heretofore been taken for orthite. Its crystallization is monoclinic with $a : b : c = .9859 : 1 : .5109$. $\beta = 98° 45\frac{1}{2}'$. The forms observed in its crystals are $\infty P\overline{\infty}$, ∞P, $\infty P2'$, $-P\overline{\infty}$, oP, $P\overline{\infty}$,

[20]Ib., xv, 1892, p. 13.
[21]Ib., xv, 1892, p. 96.
[22]Amer. Jour. Sci., July, 1892, p. 57.
[23]Amer. Jour. Sci., 1892, p.
[24]Neues. Jahrb. f. Min., etc., 1892, ii, p. 141.

$2P\infty$, P and —P. The crystals are tabular parallel to the orthopinacoid and are nearly always twinned, frequently yielding very complicated groupings. The color of the larger crystals varies from sulphur-yellow to black. Their hardness is 6.5 and density 5.006. The plane of their optical axes is parallel to the clinopinacoid, and the double refraction is negative. The extinction is 8°–15° in obtuse β, and the pleochroism varies between dark-brown and oil-green. The minerals associated with brazilite are apatite, magnetite, perofskite, ilmenite, and a spinel. An analysis of the new minerals is promised shortly.

Landauer's Blowpipe Analysis.—This little book[25] will be cordially welcomed by English and American teachers in colleges in which the use of a large manual of blowpipe analysis is undesirable. It is as suitable for classes in mineralogy as in chemistry, since it will enable the student to determine the composition of a mineral as rapidly as will the use of the great majority of Determinative Mineralogies upon the market. Moreover, it possesses one desirable advantage over those schemes in which the hardness, color and streak of chemical compounds are made to serve as distinctive tests for them, in that it compels the experimenter to study the chemical nature of the substance with which he is working. A mineral is a definite chemical substance. A student of mineralogy who is unfamiliar with the composition of bodies with which he is working, though he may know considerable about their physical properties, is neglecting the foundation upon which his knowledge of minerals must rest. The little book before us is an excellent introduction to the larger works like those of Brush and Plattner. It is, besides, complete enough for most of the purposes to which such a book is usually put. Beginning with a good description of the apparatus and reagents necessary to blowpipe manipulation, it follows with an account of the operations employed, describes Bunsens flame reactions, mentions the distinctive tests for the various chemical elements, gives Landauer's and Egleston's schemes for the systematic examination of inorganic substances, and closes with tables exhibiting the reactions of the various metallic oxides, and in a condensed form the results of the different operations described in the text. The book must find a place in many laboratories.

[25]Blowpipe Analysis, by J. Landauer. Authorized English Edition by James Taylor. Second Edition. Macmillan & Co., 1892, pp. 14 and 173.

BOTANY.

A New Edition of Wolle's Desmids.—Botanists who failed to secure a copy of the first edition of Wolle's "Desmids of the United States," and who were meditating whether or not to pay the extortionate prices charged by the antiquarian booksellers, will be glad to know that the author has brought out a new edition with considerable additions, which he is offering at $6.50. The book was well worthy of this new edition, which will doubtless find a ready sale.

Botanical Definitions.—It is the misfortune of every science that it has a mass of technical words or of words with technical meanings, which must be defined before they can be understood by the general reader. Indeed the number of these terms is so great in some sciences, notably Botany, that even the professional botanist is obliged to turn to some handy volume for the meaning of a strange word. So we must have glossaries and dictionaries of scientific terms. The latest one to appear is Crozier's "Dictionary of Botanical Terms," a pretty volume of about 200 pages, upon which the publishers (Holt & Co.) have done well their share of the work. Turning to the substance of the volume we find it disappointing. While it catalogues about 6000 words and omits few words of importance, and while its definitions are generally not false, they are in very many cases so meagre as to leave the user of the book little wiser after than before consultation. The author has failed to distinguish between a true statement regarding a word, and a *definition* of the word. Many of the definitions in this book do not define. As examples, see Accessory Gonidia ("gonidial formations in some species of Mucorini in addition to the typical kind"), Apical Cell ("the generating cell of a growing point"), Archegonium ("the female organ in the higher cryptogams"), Basidiospore ("a spore borne on a basidium, as those of mushrooms"), Linnæan System ("the system of classification devised by Linnæus, founded upon the number and arrangement of the stamens and pistils; sexual system"), Sexual System ("see Linnæan system"). On the other hand, some of the definitions of the new terms are well drawn. The older terms fare pretty well, and are as well defined as they usually are. It is the new terms which often fare badly. Yet such a book is not wholly useless. When one needs to confirm his impression as to the meaning of a word it will be helpful, for, as indicated

above, the statements are generally true. The general reader, however, and the beginner in botany who meets a word for the first time and who seeks a definition which will give him a clear notion of its meaning, will often turn away disappointed.—CHARLES E. BESSEY.

Timely Words as to the Nomenclature Question.—At this time, when there is not a little of ferment and effervescence over the rules which should govern in the nomenclature of plants, it will be well for us all to read the following remarks made by Alph. DeCandolle in the introduction to the "Paris Code" of 1867. They convey very well the ideas of the "moderns" of to-day.

"The system of nomenclature of organized beings, founded by Linnæus, was looked upon until the middle of this century as extremely ingenious, and has been thought, by some authors, a most admirable one. It was quoted in philosophical lectures and found superior to that of chemical nomenclature, on account of its adapting itself more readily to changes necessitated by the progress of discovery. Botanists professed for it the greatest veneration. They boasted of having developed a better nomenclature than zoologists, which is not surprising, as the most illustrious botanists, thirty or forty years ago, gave infinitely more attention to this subject than zoologists.

Nevertheless, of late years, a change has been perceptible; opinion is wavering, enthusiasm abated. Here and there, in different countries, doubts have arisen and complaints have been made regarding the system of botanical nomenclature." * * *

"It follows that it is useful—every twenty years, for instance—to revise the *ensemble* of received rules." * * *

"Without going far back it is easy to see that since the end of the eighteenth century botanists have endeavored to free themselves from many useless shackles put on by Linnæus and tightened by his disciples, above all with relation to the choice of generic names. De Candolle [the elder, in *Théorie Elémentaire*] was ruled by the idea of having the law of priority properly respected, a law which, fifty years ago, was often unscrupulously infringed." * * *

"The time must however come, when actually existing vegetable forms having all been described, herbaria containing undoubted types of them, botanists having made, unmade, or oftentimes remade, elevated or lowered, and above all modified, some hundred thousand groups, from orders downward to simple varieties of species, the number of synonyms having become infinitely greater than that of admitted groups—it will become necessary to effect some great revolution in the

formation of science. This nomenclature that we are striving to improve will have the appearance of an old scaffolding, made up of parts laboriously renewed one by one, and surrounded by a heap of more or less embarrassing rubbish, arising from the accumulation of pieces successively rejected. The edifice of Science will have been constructed, but it will not be sufficiently clear of all that has served to raise it. Perhaps there will then come to light something very different from the Linnæan nomenclature—something will have been devised for giving definite names to definite groups." * * *

"In the meanwhile, let us improve the system of binomial nomenclature introduced by Linnæus. Let us endeavor to accommodate it to the continued and necessary alterations that take place in science, and for this purpose let us diffuse as well as we can the principles of the method ; let us attack slight abuses, slight negligence, and let us come, if possible, to an understanding on debated points. We shall thus have prepared, for some years to come, the way for better carrying out works on systematic botany."

Engler and Prantl's "Naturlichen Pflanzenfamilien."—This great work is making such headway that another year will nearly complete it. During 1893 we are promised the Fungi, Hepaticæ, Musci and the Pteridophytes. The Gymnosperms and Monocotylodons, are already completed, while but few families of the Dicotylodons remain to be worked. Recent numbers treat of the Compositæ (74), Oleaceæ, Salvadoraceæ and Loganiaceæ (75), and Myxogasters and Fungi (76), the last by the well-known Mycologist Schröter. His tabular view of the system of classification of the Fungi which he adopts is instructive. See page 50.

- Phycomycetes.
  - Oömycetes.
    - Sporangieæ
      - Hemisporangieæ — *Chytridineæ.* *Ancylistineæ.*
      - Eusporangieæ — *Monoblepharidineæ.* *Saprolegnineæ.*
    - Conidieæ — *Cystopodineæ.* *Peronosporineæ.*
  - Zygomycetes.
    - Sporangieæ — *Mucorineæ.*
    - Conidieæ — *Entomophthorineæ.*
- Eumycetes.
  - Ascomycetes.
    - Hemiasceæ — *Protomycetineæ.* *Ascoidineæ.*
    - Euasceæ.
      - Protoasceæ — *Saccharomycetineæ.* *Endomycetineæ.*
      - Holoasceæ.
        - Hymenioasceæ.
          - Gymnocarpeæ — *Taphrineæ.* *Helvellineæ.*
          - Hemikleistocarpeæ — *Pezizineæ.* *Phacidiineæ.*
          - Kleistocarpeæ — *Tuberineæ.*
        - Plectasceæ — *Gymnoascineæ.* *Elaphomycetineæ.*
        - Pyrenoasceæ — *Perisporiineæ.* *Sphaeriineæ.* *Hysteriineæ.*
  - Basidiomycetes.
    - Hemibasidieæ — *Ustilagineæ.* *Tilletiineæ.*
    - Eubasidieæ.
      - Protobasidieæ.
        - Phragmobasidieæ — *Uredineæ.* *Auriculariineæ.*
        - Schizobasidieæ — *Tremellineæ.* *Dacryomycetineæ.*
      - Holobasidieæ.
        - Hymeniobasidieæ.
          - Gymnocarpeæ — *Exobosidiineæ.* *Thelephorineæ.* *Clavariineæ.* *Hydneineæ.* *Polyporineæ.*
          - Hemiangiocarpeæ — *Boletineæ.* *Agaricineæ.* *Phallineæ.*
          - Angiocarpeæ — *Hymenogastrineæ.* *Lycoperdineæ.* *Nidulariineæ.*
        - Plectobasidieæ — *Sclerodermineæ.*

ZOOLOGY.

Locomotion of Limpets.—Herdman records[1] several facts which seem to militate against the view that limpets do leave their resting place and return to it again. It has been shown that they can leave and travel some distance, but he found a specimen of *Patella vulgata* which was sticking to a cylindrical bar of iron and which had the shell molded to fit the surface. Now as the bar was short and free to move about, the probabilities are that if it once left the support it would never be able to return to it. In other cases he found limpets at the bottom of deep pits, from which it would be very difficult, if possible at all, for them to extricate themselves.

Tunicate Studies.—Herdman publishes[2] some notes on the structure of the Appendicularian, Œkopleura. This form was studied by serial sections, and the results, most interesting, are: The condition of the endostyle as a diverticulum to a great extent shut off from the branchial sac; the presence of a genital duct; the distribution of the enlarged ectoderm cells and the cuticular test; the exact course of the nerve cord through the posterior part of the body; and the shapes and positions of the alimentary and reproductive viscera.

In the same publication[3] Garstang points out that *Appendicularia mossii* (*Mossia dolioides*) is to be regarded as a member of the genus Kowalevskia of Fol, and that it in reality has not that importance from the phylogenetic standpoint which was attributed to it by Herdman in his "Challenger" report.

The Skeleton and Teeth of the Australian Dugong.—Zoologists are indebted to Prof. G. B. Howes and Mr. J. Harrison for a valuable paper on the skeleton and teeth of the Australian Dugong, of which the following is an abstract:

"The authors showed that the vertebral epiphyses are more fully developed than Albrecht has suspected, and that they appear late and rapidly ankylose with the centra, a feature of especial interest, in view of Lefévre's alleged discovery of fully developed epiphyses in *Halitherium schinzii* and *Metaxytherium*. On comparison with the Cetacea

[1]Trans. Liverpool Biol. Soc., vi, 22, 1892.

[2]Trans. Liverpool Biol. Soc., vi, 40, 1892.

[3]L. C., p. 57, 1892.

they sought to associate the reduction of the epiphyses with adaptation to an aquatic existence.

"In dealing with the limb-skeleton they described a longitudinal cleavage of the phalanges, akin to that recorded by Kükenthal for the Cetacea. The only structures observed which were at all comparable to supernumerary phalanges were derivations of the terminal (ungual) ones, arising proximally; and the observations lend no support to Kükenthal's view that supernumerary phalanges are epiphysial in origin.

"The first upper incisor and the four lower ones of either side were shown to have milk predecessors, which are early absorbed. Five teeth were shown to be present on either side of the symphysial region of each mandibular ramus of *Manatus*, the fifth one being claimed as a canine; and in this animal the authors described milk predecessors to the two anterior pairs of mandibular cheek teeth."

On the Cephalo-humeral Muscle and the So-Called Clavicle of Carnivora.—At a meeting of the Philadelphia Academy, Dr. Harrison Allen spoke of the peculiarities of the cephalo-humeral muscle in mammals and invited especial attention to the presence of a small fibro-cartilaginous disc in the junction of the cephalo-humeral with the muscles which are inserted in the bones at the region of the shoulder. This is well defined in *Felis* and is identified as a rudimental clavicle. Dr. Allen has detected this structure in *Herpestes, Taxidea, Cercoleptes, Bassaris,* and *Procyon.*

The cartilage is either in the form of a flat disc or a minute scythe-shaped rod, and is constant in lying directly over the greatest convexity formed by the round of the shoulder. It seems to give strength to the center of a muscle system of which the cephalic, cervical, pectoral and latissimal sheets are parts. The identification of such a plate or rod with a true clavicle is doubtful, since in *Balantiopteryx* (a genus of bats) the structure above described is remarkably developed, while the clavicle is as well formed as in any other animal. The long rod-like body is continuous with a fascicle of fibres arising from the pectoralis and receives the insertion of the occipito-pollicalis. The anterior end of the rod lies in the upper border of the wing membrane and is continuous with the fibrous thread which represents the tendon of the occipito-pollicalis as this muscle is defined in the bats generally. From both the proximal and distal divisions of this muscle delicate fascicles pass toward the elbow and the entire plan appears to be associated with the rudiment of the characteristic skin sac. Slight modification of this arrangement is met with in the allied genus *Rhynchonycteris.*

Comparison of this arrangement with that seen in the common brown bat (*Adelonycteris fuscus*), the noctula bat (*Noctulinia noctula*), and the false vampire (*Vampyrus spectrum*) showed by the part taken by the rod in *Balantiopteryx* is the tendon of a pectoral muscle-fascicle which is inserted into the occipito-pollical muscle as it crosses the shoulder, while in the group of the Molossi the muscle-fascicle is fleshy throughout its entire extent, but on the whole preserving the same relations. Thus the fibro-cartilage of *Balantiopteryx* is represented by fibrous tissue in *Adelonycteris* and both these in turn by muscle in the Molossi. Dr. Allen believed that it was inexact to speak of a clavicle and of this rod as things which were equal. The clavicle acts with the scapula in supporting the head of the humerus but in no wise limiting or determining its movements, while the rod is always over the outer aspect of the shaft of the humerus below its head and acts as a check to abduction of this bone.—Proceeds. Phila. Acad., Pt. 2, 1892.

A New Synaptomys from New Jersey.—While trapping for a type series of the new race of *Evotomys* described by Mr. Stone in the present number of THE NATURALIST, I had the fortune to secure a specimen of this long-looked-for genus, which is, I believe, the first taken in flesh east of the Alleghany Mountains.

It had previously been detected by the U. S. Department of Agriculture in the rejects of a barn-owl living in the tower of the Smithsonian Institution.

A comparison of the New Jersey specimen with two *Synaptomys cooperii* from Ohio, courteously loaned by Mr. J. A. Allen, of the American Museum of Natural History, N. Y., shows such marked specific differences that it will be unnecessary to more than briefly allude to them.

SYNAPTOMYS STONEI.—Sp. nov. Type No. 567. ad. ♀. coll. S. N. Rhoads, May's Landing, N. J. Dec. 2, 1892.

Special Characters.—Outward appearance and proportions as in *S. cooperii.* Above blackish-brown, with black hairs more predominant over the shorter brown hairs than in *cooperii.* The same color reaching around sides of belly instead of being confined to dorsal area as in *cooperii.* Hoary gray belly and neck of *cooperii* replaced by dark plumbeous gray. Feet, including soles, plumbeous, without brown shade. Two middle toes of fore-feet and four inner toes of hind feet, including nails, white. Tail unicolor plumbeous gray. Lips encircled with narrow white edgings.

Skull narrower, shallower, and, viewed from above, less angular than that of *cooperii*, but of same length. Lower jaws viewed from below, ditto. Incisors shorter, broader, and less cylindrical, with sulcation of upper pair much more distinct. Zygomatic foramen longer and narrower. Sagittal suture and parietals relatively much longer; interparietal transversely narrower, longitudinally longer. Supra-occipital in *cooperii* twice as wide as deep, in *stonei* thrice as wide as deep.

Molars one-third wider and one-eighth longer in *stonei*. In *cooperii* the length of the symphysis mandibuli just equals the distance from its posterior end to the angle formed by the antero-inferior border of the masseteric fossa; in *stonei* the symphysis is one-third longer.

Posterior face of angle of lower jaw in *stonei* very stout, abruptly rounded, and recurved outward; in *cooperii* it is slender, spatulate, elongated posteriorly in a nearly vertical plane, and the margin below the condyle not thickened as in the former species.

Measurements in millimeters of the New Jersey specimen in the flesh, with averages of six alcoholic specimens of *cooperii*, made by Dr. Coues, are given:

	Full length.	Tail.	Foot.	Ear.
Synaptomys cooperii..........	105	18	18	8
Synaptomys stonei.............	117	18	18	9

The age of specimens on which the above cranial and color characters are based is evidently about the same. In other respects they may be safely considered normal adult representatives of the species in the different localities where they were taken. The new species may fittingly bear the name of my friend and colaborer, Mr. Witmer Stone, Curator of Birds in the Philadelphia Academy of Natural Sciences.

SAMUEL N. RHOADS.

A New Evotomys from Southern New Jersey.—On October 25, 1892, while collecting small mammals near May's Landing, New Jersey, in company with Mr. S. N. Rhoads, I captured a specimen of *Evotomys*, a genus which has not previously been reported from south of Massachusetts and the Adirondacks, except in the higher mountains of North Carolina. The next day three more specimens were secured, and subsequently (December 2) Mr. Rhoads collected four others in the same locality. A comparison of these specimens with a series of *Evotomys gapperii* from Northern New York, which is apparently the most closely related form, shows them to be subspecifically distinct,

and I therefore propose for the New Jersey animal the name *Evotomys gapperi rhoadsii* in honor of my friend, Mr. Samuel N. Rhoads.

The comparison of a series of skulls of *E. gapperii* and *E. g. rhoadsii* fails to show any constant differential characters, though the immature specimens of the new race are peculiar in the structure of the last upper molars. In these teeth the first reentrant angle on the inside is opposite the second salient angle on the outside instead of the first reentrant angle as is the case in the adults of both forms. One young specimen of *E. gapperii* shows a tendency to this structure, but in all the other specimens that I have examined the reentrant angles meet, and the outer one is deflected posteriorly.

In proportions the New Jersey race seems to average rather smaller than *E. gapperii* from the Adirondacks, while the tail is shorter and the feet slightly longer than in that species.

As regards coloration *E. g. rhoadsii* is everywhere darker than *E. gapperii*, and has a plumbeous cast on the sides and flanks, while it lacks almost entirely the buff suffusion generally seen on the sides and under surface of the latter species.

Above the color is decidedly darker than in *E. gapperii*, and there are a great many more black hairs scattered over the back. The reddish area is not so well defined and the color is darker—more of a mahogany shade. The tail is distinctly bicolor, but the upper surface is darker than in *E. gapperii*, and the feet have a decidedly gray suffusion, contrasting strongly with the pure white of the latter species.

Some immature specimens of *E. gapperii* approach adult *E. g. rhoadsii* in general coloration, but the young of the latter race with which they should properly be compared have scarcely a trace of the reddish dorsal area, the middle of the back being brownish and the sides gray. The table on next page, will show the comparative measurements of the two forms, the specimens of *E. gapperii* being selected from a series kindly loaned me by Mr. G. S. Miller.

Dr. C. Hart Merriam, of the Department of Agriculture, Washington, D. C., has kindly examined my New Jersey material and compared it with *Evotomys carolinensis* and other species to which I had not access, but its closest relationship appears to be with *E. gapperii.* All the specimens of this new mouse so far secured were taken in a cranberry bog on the Egg Harbor River, about a mile above the town of May's Landing, N. J. The unexpected occurrence of this boreal genus well within the Carolinian Fauna may probably be accounted for by the theory already advanced by Dr. Merriam that in these damp bogs, where the temperature is much lower than in the surrounding dry

Evotomys gapperii.

No.	Sex.	Locality.	Date.	Length.	Tail Vertebræ.	Hind Foot.
$\frac{1570}{1367}$	♂	Peterboro, N. Y.	July 17, 1892	151 mm.	41 mm.	17 mm.
$\frac{1577}{1374}$	♀	" "	July 19, 1892	165	51	18.4
$\frac{1637}{1434}$	♀	" "	Aug. 1, 1892	160	46	19.6
$\frac{1340}{1158}$	♂	Keene Valley, N. Y.	Mar. 17, 1892	155	45	20
		Average..		158	46	19

Evotomys gapperii rhoadsii.

No.	Sex.	Locality.	Date.	Length.	Tail Vertebræ.	Hind Foot.
160	♂	Type, Coll. of W. Stone.	Dec. 2, 1892.	142	40	20
161	♀	" "	" "	130	37	20
570	♀	Coll. of S. N. Rhoads.	" "	123	34	21
571	♂	" "	" "	130	36	20
		Average..		131	37	20

areas, the conditions of life are quite suited to more boreal species, especially animals of nocturnal habits. The presence of various Ericaceous and other boreal types of plant life in these locations also supports this hypothesis.—WITMER STONE, Academy of Natural Sciences, Philadelphia.

Zoological News.—VERTEBRATA.—Some new reptiles and fishes from Australia are described by J. Douglas Ogilby. The list comprises *Typhlops curtus* from the Gulf of Carpentaria, *Hoplocepalus suboccipitalis* from Morel, and *Clupea sprattelloides* from rivers flowing into Port Jackson and Botany Bay. The latter species has until now been supposed to be the young of *C. novæ-hollandiæ*.—Records Austr. Mus., Vol. ii, No. 2.——F. W. True reports that the collection of African mammals presented to the National Museum by Dr. Abbott contains several species apparently new: *Dendrohyrax validus, Mus aquilus, Dendromys nigrifrons, Sciurus undulatus, Cephalophus spadix.* The known range of several species is considerably extended by Dr. Abbott's labors. The mammalian fauna of the Kilima-Njaro region as indicated by this collection includes seventy-one to seventy-three species.—Proceeds. U. S. Natl. Mus., Vol. xv, pp. 445–480.

EMBRYOLOGY.[1]

Gastrulation of Aurelia.[2]—Frank Smith has entered into the controversy between Claus and Goette concerning the origin of the entoblast of Aurelia. The results obtained from his first sections led him to think that the conclusions reached by Goette for *Aurelia aurita* would be confirmed in the case of *A. flavidula.* Better staining, thinner sections and more accurate orientation have, however, made it certain that the gastrulation in this species is much more in accord with the description given by Claus and that the process really is one of invagination. The result of cleavage is a one-layered blastosphere as in *A. aurita.* The cells of the blastosphere are usually somewhat shorter at one pole than elsewhere, and it is from this region that the entoblast is formed. It develops as a single continuous layer of cells surrounding a small cavity, the coelenteron. From the beginning there is a narrow blastopore. Only a small portion of the wall of the blastosphere is concerned in the invagination, and to that extent it is not typical. The cœlenteron is, however, at all stages, an open sac-like cavity, and therefore noticeably different from that of *A. aurita* as described by Claus. The cœlenteron enlarges until the cleavage cavity is entirely obliterated and the entoblast everywhere comes into contact with the ectoblast. The entoblast, at first thin, thickens after the completion of gastrulation.

While the entoblast is formed by invagination, ingression of cells from the wall of the blastosphere into the cleavage cavity does occur, although only in a minority of cases. It may happen any time after the blastosphere contains about 100 cells, sometimes before invagination. When this phenomenon takes place it is similar to that represented by Goette (Figs. 1–5) for the earlier stages of the blastula in *A. aurita,* and consists of the migration into the cleavage cavity of one or two, rarely more than three, of the cells of the blastospheric wall. Soon after invagination the nucleus of the cell disappears and the cell breaks down, or, less frequently, persists until gastrulation is complete. In the latter case it becomes forced through the entoblastic wall into the cavity of the cœlenteron. The cause or purpose of this immigration does not appear.

[1]This department is edited by Dr. E. A. Andrews, Johns Hopkins University.

[2]Bull. Mus. Comp. Zool., Harvard, xxii.

The author thinks that the difference in opinion between Claus and Goette is partially due to there being two kinds of cells that find their way into the cleavage cavity. Besides the large cells just described he found in a much smaller number of cases one or two very small cells that look precisely like the small cells that appear in the deeper part of the ectoblast at about the time gastrulation begins.

There is no evidence that the immigrating cells have anything to do with the formation of the entoblast, and Goette's case is further weakened by the fact that all the conditions shown in his figures (6–9) can easily be reproduced from sections of invaginating gastrulæ of a single stage of development.

Cleavage in Aequoria Forskalea.—Dr. V. Hæcker[3] contributes an interesting series of observations on this subject. He finds that when the specimens are in good condition the time relations between the successive periods of activity are remarkably precise.

If ripe, the eggs are laid between 7 and 7.30 A. M. The first polar body is extruded at 9 A. M. The entrance of the spermatozoan and the division to form the second polar nucleus takes place at 9.30. At 10 A. M. the dyaster stage of the first cleavage nucleus occurs, and with it the first indication of the division of the cell body. The daughter nuclei are undergoing metakinesis at 11, and at 12 the four nuclei of the next set are in the dyaster stage. The nuclear divisions continue to take place an hour apart at least as far as the sixty-four cell stage, and this seems to show that the nucleus is not affected at this period by the amount of cell protoplasm that it controls. Normally nuclear division takes place at the same time throughout the egg, and the blastomeres are of equal size up to the sixty-four-cell stage.

When eggs are laid after the specimen has been kept in an aquarium several days, irregularities generally occur in the time of nuclear division and in the size of the blastomeres. At the same time a pathological form of nuclear division, the triaster, appears, and the mass of cells loses its spherical shape.

A remarkable feature of the cleavage of the egg of Aequoria is the presence of a body for which the author proposes the name *Metanucleolus.* In the older ovarian eggs and in eggs just laid there is a large nucleus containing a very fine network of chromatin and a large spherical or reniform nucleolus. About half an hour after the egg is laid this nucleolus appears to have been extruded, for the nucleus is now much smaller than it was and has no nucleolus, while in the egg

[3]Archiv. fur Mikro. Anat., 40 Bd., 2 Heft.

outside of the nucleus but close to it there is a body resembling the former nucleolus in every particular, except position. This body, the metanucleolus, never divides, there is never any radial arrangement of the protoplasm about it, and it may be found in one of the blastomeres until a later stage in the cleavage. From a review of the work of Metschnikoff, Boveri, and others, the author thinks that homologous structures have been seen, although wrongly interpreted, in the Leptomedusæ, Anthomedusæ, Siphonophores and apparently also in Mytilus and Sagitta. He has also examined Weismann and Ischikawa's preparations of the winter eggs of Daphnids, with the result that he regards the paracopulation cells as not cells at all, but as in all probability structures homologous with the metanucleoli of the medusæ.

Another point of interest in this paper is the numerical relation between the chromosomes of the second polar spindle and of the first cleavage spindle, there being six in the former and twelve in the latter. Boveri had pointed out that in the forms in which this point had been studied, while the number varied in different species, the number of chromosomes in the cleavage spindle was always just double the number in the last polar spindle, and he had also noticed that the number of the latter in certain species could be arranged in a geometrical series in which the numbers are forms of two (2, 4, 8, 16, 32). Hæcker reviews the literature of the subject and shows that there may be two other series besides this one. There is a series of the forms of three (3, 9, 27, etc.), of which, however, there is but one example, Echinus with nine chromosomes, and then there is a mixed double and triple system (6, 12, 18, 24, 36, 48, etc.), to which Aequoria belongs, as well as the greater part of the insects and the vertebrates. He concludes that all cases so far known may be arranged in three systems in such a way that in general nearly related forms belong to the same system.

R. P. Bigelow.

(1) Zeit. f. Wiss. Zool., 49, 1890, pp. 503–580, plates 24–26.

(2) Zeit. f. Wiss. Zool., 51, 1891, pp. 685–730, plates 35–37.

(3) Zeit. f. Wiss. Zool., 54, 1892, pp. 1–249, plates 1–12.

ENTOMOLOGY.[1]

The Pupa of Argyramœba œdipus Fab.—The description given below is drawn from a pupal skin sent to me with the fly by Prof. C. P. Gillette, who bred the latter from a nest of *Odynerus* sp., at Fort Collins, Colo. In a paper which will be published in *Psyche,* I have described the pupa of *Toxophora virgata* O. S., and also made some mention of the pupæ of Bombyliidæ which have so far been described. The pupa of the present species differs quite markedly in detail from that of the Toxophora above mentioned.

Pupa of *Argyramœba œdipus:* General color of empty pupal skin very pale straw colored; the cephalic horns black, reddish-brown basally, anal horns black, slightly reddish-brown at base; dorsal rows of ridges reddish-brown, the terminal spinous processes blackish; prothoracic spiracles reddish-brown, other spiracles but little darker than rest of integument, slightly brownish. Head conforming to shape of head of adult fly, more or less sub-spherical in form. Eight cephalic horns or teeth arranged in four pairs, the three anterior pairs joined in a common base, the posterior pair removed from others; anterior pair longest, their rufous brown joined basal portion distinctly shorter than their black free terminal portion, moderately slender, nearly straight, directed forward, gradually tapering to tips; second and third pairs more closely approximated one pair to the other than are the first and second pairs, but the two horns of each pair widely removed from each other, both pairs directed nearly forward but at a slightly more downward angle than first pair; third pair much shorter than second, more curved or claw-like; posterior pair closely approximated at base, nearly as large as third pair, but straight and directed inferiorly, situated nearly in middle of ventral surface of head segment; a pair of quite widely separated divergent bristles on outer dorsal surface of anterior cephalic horns; a more approximated nearly parallel pair just posterior to these but arising from integument of head near anterior dorsal edge, being situated just behind the suture at base of cephalic horns; a divergent pair situated just anterior to base of the posterior of fourth pair of cephalic horns; a small bristle on each side at hind margin of ventral surface of cephalic segment. Thorax a little wider than head, the neck being somewhat constricted; a pair of

[1]This department is edited by Clarence M. Weed, Hanover, N. H.

closely approximated short bristles arising from the same papilla on lateral dorsal surface of thorax a little anterior to middle; a bristle below these on pleural surface, another still below and a little anterior to this one. Wing cases reaching about to base of third abdominal segment, leg cases a little longer. Scutellar segment about as wide as thorax, with a transverse row of ten or eleven long, more or less curled hairs on each side of dorsum approximated to anterior margin, there being a bare space on median portion of segment between the inner ends of the rows; about ten somewhat longer similar hairs on extreme lateral portion of segment on each side, arranged in a more or less complete semicircle, the open portion of the semicircle being toward the posterior end of body; the lateral hairs are longer and slightly stouter than those of dorsum, being nearly as long as transverse width of segment. Abdominal segments one to four, about same width as scutellar segment, each armed on dorsum with a transverse row of short longitudinal parallel chitinous ridges or very narrow plates, there being thirteen in a row on first and second segments, twelve on third segment, and nine on fourth, the rows a little approximated to posterior margin of segment, especially in middle; these ridges are about two-sevenths as long as length of segment, those in middle of rows being the largest and heaviest, the outer ones shorter and diminishing in size, those on fourth segment less heavy than those of first to third segments, and each ridge is produced at its ends into a spinous or hook-like process, the ridges in profile presenting a crescentic appearance with the concavity uppermost. The other abdominal segments without these rows of ridges, fifth segment nearly as wide as preceding, sixth segment hardly narrower than fifth, the fifth and sixth segments each with a transverse continuous row of hairs on dorsum arising from a transverse ridge, extending down to lateral ventral edge of segment and continued on sides of venter, these rows somewhat approximated to posterior margin of segment. Segments (abdominal) one to four with a thin transverse row of shorter weak hairs on each side of dorsum, arising in posterior edge of rows of ridges, extending down on each side to lateral margin, no hairs on median dorsal portion; same segments with a more or less complete lateral semicircle of longer hairs as on scutellar segment, but somewhat weaker and shorter than those on that segment, the hairs on fourth segment extending beneath on sides of venter. Seventh abdominal segment much narrowed, rapidly and evenly narrowing from base to posterior margin, its width on posterior margin hardly more than one-third its width anteriorly, its mean width about one-half that of sixth

segment, with a transverse row of several hairs on each side of dorsum extending below on edge of venter, discontinued in middle on dorsum, slightly approximated to posterior margin of segment. Eighth or anal segment narrow, same width as posterior margin of seventh, nearly as long (to base of horns) as wide, terminated by three pairs of anal horns; anterior or upper pair short, small, situated at base dorsally of middle pair; middle or second pair long, curved slightly upward terminally, nearly as long as length of segment, widened inwardly on basal half so that the bases are closely approximated, inner outline hollowed out on apical portion, longitudinally corrugated at base above, with a dorsal longitudinal groove widening to hollowed portion and then extending narrowly to tip, moderately sharp at tips; third or inferior pair short, small, hardly as large as anterior pair and not so stout at base, directed more downward than middle pair, situated on outer base ventrally of middle pair; just anterior to first pair on dorsum there is a median very small spinous tubercle, apparently a rudiment (or herald) of a fourth pair of anal horns. Prothoracic spiracle situated on lateral front border of thorax (prothorax) just anterior to wing bases, mesothoracic spiracle not apparent, metathoracic spiracle situated anteriorly on lateral edge of dorsum of scutellar segment; first to sixth abdominal pairs of spiracles situated on anterior edge laterally of dorsum of first to sixth abdominal segments; seventh pair situated one on each side of dorsum of seventh segment immediately behind the transverse row of hairs. It is interesting to note that a quite long section of the tracheæ is left attached in most cases to the spiracles on inside of the pupal skin, especially to the thoracic pairs. The fly escaped by the pupal skin splitting along the dorsal median line of the head and thorax, the slit extending slightly into the scutellar segment; also splitting laterally backward on each side of head from a little above the base of anterior cephalic horns along what would nearly correspond to the frontal fissure in Muscidæ, the break curving shortly and obliquely upward to thoracic suture, and allowing the nearly triangular posterior dorsal or upper section of the integument of the head to become loosened laterally below from its junction with the thorax, and hanging like a flap by its median dorsal junction.

Length, 9½ mm.; width of basal abdominal segments, 2½ mm.

The anal extremity of this pupal skin is distended with a dirty colored hardened fluid ventrally, just below and anterior to anal horns, into a large round tubercle with a subcentral deep pit or orifice-like depression which is approximated to posterior margin, the anterior portion of the tubercle being greatly bulged and distended. The

diameter of this false tubercle is as great as the posterior width of the sixth abdominal segment. The fluid which distended it is perhaps homologous with the meconium of butterflies.

The description of the manner in which the pupal skin splits to allow the escape of the fly was omitted in the description of the pupa of *Toxophora virgata* in the article above referred to. It is accomplished in the same way as just described for the present species, except that the dorsal median split does not reach posterior margin of thorax, and the dorsal pieces of head are not so much detached from their lateral thoracic fastenings, and are left more quadrangular in shape by the oblique lateral breaks of head. It may also be mentioned that a section of the tracheæ is left attached to inside of prothoracic spiracles.

My reasons for calling the first abdominal segment of other authors the scutellar segment, are stated in the article on Toxophora.

C. H. Tyler Townsend.

The Horn-Fly in Canada and Texas.—Mr. James Fletcher, Entomologist to the Canadian Department of Agriculture, announces[2] that the Horn-fly (*Hæmatobia serrata*) has appeared in enormous numbers in the Provinces of Ontario and Quebec, causing considerable anxiety to stock-owners. It was first definitely heard from at Oshawa, Ont., July 30, 1892. An excellent résumé of the life-history of the pest and of the means of preventing its injuries is given.

That this insect is also spreading rapidly in the southwest is shown by the following note from Dr. Mark Francis, of the Texas Agricultural College, who wrote me under date of Oct. 18, 1892, from College Station: "The horn-fly seems to be spreading westward. I saw it at Stillwater, Oklahoma, two weeks ago. It has not reached here yet, but I saw great numbers of them at Hempstead, Texas (forty miles southeast of here) last Friday. I think there can be no doubt as to its identity, as I have compared them with type specimens from Prof. H. Garman, of Kentucky."

Two days later Dr. Francis again wrote that the horn-fly was observed at College Station, Oct. 19, for the first time.

In Southern New Hampshire this insect has been very numerous the past season, and it has been gradually spreading northward through New England. But a hopeful report comes from New Jersey, where the insect was first observed. Prof. J. B. Smith states that it now causes little trouble there, and is seldom noticed as specially abundant.

[2]Central Exper. Farm, Ottawa, Bull. No. 14.

The Wheat Frit-Fly.—Dr. Otto Lugger reports[3] extensive damage to wheat in the northwest by a larva supposed to belong to one of the frit flies. The stem is injured about three inches above the ground, the larvæ occurring immediately above a node. The insect so weakens the plant at this point that the stalk falls over some time before harvest, the grains do not fill out, and reaper passes over the fallen stem. The puparia resemble the "flaxseed" state of the Hessian fly, and are found within the culm. It is supposed that the insect hibernates with the puparia. Burning and plowing under the stubble are the remedial measures recommended. This is apparently the worst frit-fly attack on wheat yet recorded in America. Dr. Lugger says that in many places fully one-fourth of the entire crop of wheat has been destroyed and in a great many more the losses amount to at least one-tenth.

Entomological Notes.—That excellent periodical, *Entomological News*, has instituted a department of economic entomology, with Prof. J. B. Smith in charge. This magazine will prove very useful to amateur as well as professional entomologists, and deserves cordial support. There has lately been a tendency to insert only very short articles, or to continue a single article through several issues (somewhat after the fashion of *Entomologica Americana*), which is unsatisfactory to all concerned.

Mr. M. H. Beckwith discusses[4] the injuries of the strawberry weevil (*Anthonomus musculus*) in Delaware, and reports finding the larvæ feeding upon the ovaries of strawberry blossoms. He surmises that there may be two or possibly three broods each year, but has been unable to trace the life-history of the insect during the latter summer months.

Concerning the recent bestowal by the University of Heidelberg of the honorary degree of Doctor of Natural Science upon Baron C. R. von Osten Sacken, Prof. S. W. Williston writes:[5] "Baron Osten Sacken's work has been chiefly related to American Dipterology, but the ripe fruits of his wide experience and broad grasp of principles have enriched all dipterology, and, I believe, all entomology. Others there are and have been who have won enviable honors in systematic dipterology; others who have written more extensively than he, but no one has written more that will be appreciated in the future than has Baron Osten Sacken.

[3]Minn. Exp. Station, Bull. No. 23.

[4]Delaware College Exp. Station, Bull. No. xviii.

[5]*Psyche*, Vol. 6, p. 346.

Dr. J. C. Neal discusses[6] a number of injurious insects that have appeared in Oklahoma. He includes *Pieris rapæ, Plusia brassicæ, Heliothis armigera, Diabrotica vittata, Lytta cinerea, Oncideres cingulata,* and *Blissus leucopterus.*

The recent biennial report of Prof. S. A. Forbes as Director of the Illinois State Laboratory of Natural History, shows that entomological studies are being vigorously prosecuted in that favored State. Fully 20,000 specimens have been added to the pinned collections, and 2700 bottles and vials to the biological series. We are glad to note the announcement to two important papers soon to appear in the Bulletin of the laboratory, the first by Mr. John Marten, containing descriptions of new species of Illinois gall gnats, and the second by Mr. C. A. Hart, a descriptive list of the aculeate Hymenoptera of Illinois.

PSYCHOLOGY.

Notes on Habits of Certain European Birds.—M. Ch. von Kempen has recently published some observations on birds from which the following extract is quoted to show the voracity of the ordinary sparrow-hawk (*Accipiter nisus*):

"For several years I lived in the country, and was accustomed to write during the summer near an open window. The apartment had from one side a view of the garden; from the other one looked out over the fields. Suddenly I saw a sparrow-hawk dart through the room; he flew with such violence that he broke the glass of the window, against which he dashed in his impetuous flight. I soon had an explanation of the circumstance. A linnet (*Sylvia hortensis*) perched near me was evidently the attraction. The warbler had flown into the room to escape the hawk, which in headlong pursuit, had gone through the room like an arrow from a bow.

"In February, 1889, I had in my town garden a certain number of lapwings (*Vanellus cristatus*); each evening, when I would go to shut them up in a cage, I would find one less than I had counted in the morning; I attributed this loss to a cat belonging in the neighborhood. The third day on missing another of my pets, I resolved to discover the thief, and concealed myself for that purpose. In the morning I saw a sparrow-hawk coming straight to my garden from the old tower

[6] Oklahoma Agri. Exp. Station, Bull. No. 3.

of Saint Bertin. In spite of my presence he tried to carry off his daily meal, but I struck him with my hands and made him drop his prey. I then put my lapwings in their cage, as I was expecting to go out after dinner. What was my astonishment on going to see my birds in the evening to find the sparrow-hawk keeping them company in the cage. He had forced himself in through the bars but could not get out in the same way, and so was a prisoner with the lapwings, which he had not, as yet, dared to touch. The hawk was a young male, and now forms a part of my natural history collection."

Two other citations show that birds can familiarize themselves with objects which ordinarily terrify them.

"The jackdaws (*Corvus monedula*) and barn-owls (*Strix flammea*) are very numerous in all the towers of Saint-Omer; they are so accustomed to the noise of the clocks that they build their nests against the clappers.

"Last year I saw a nest of a titmouse (*Parus major*) built in a little mill that children played with in a garden. This noisy scarecrow, turning with every wind, did not frighten the saucy birds, and they reared their young with comfort.

"I now give two observations of another sort that prove beyond a doubt that birds possess a memory:

"I had in the country two domestic peafowls (*Pavo domesticus*); they were accustomed to come every evening to get their slice of bread cut in small bits before perching themselves on the roof; and if they were forgotten they would wait nearly all night before abandoning all hope of the treat. They were so tame that the male, as well as the female, would eat from our hands. After I had gone to the city, in order to keep the peafowls out of the garden, where, it is well known, they cause great havoc among the vegetables, the berries, and the currants, they were given corn in abundance in a place quite remote, but they declined these overtures and returned constantly to the place where I had fed them; I found them there on my return the following year. During the summer the female laid ten eggs, a less number than usual; nine young chicks were born, which, following the example of their parents, came every evening to look for their repast.

"During the winter a storm, accompanied by a fall of snow, burst upon us during the night, and the unfortunate peafowls were thrown from their perch on the roof; some wandering dogs strangled them, and we found their remains scattered over the field.

"I have at this time two laughing gulls (*Larus ridibundus*) living. I give them twice a day, at regular hours, bits of meat. Some jack-

daws (*Corvus monedula*) come every day, at the exact hour, never too soon, never too late, from the towers of the Chapel of the Lyceum, an old church of the Jesuits, to snatch from me, or from any one who takes my place, the bits of meat that we give to the gulls.

"Last year a dwarf hen which belonged to me chased from its nest a female pigeon which had been setting for two days, broke up the eggs, and laid one of its own in the nest. The pair of pigeons continued to care for the egg of the hen, and, at the end of twenty-one days (which was really twenty-three for the pigeons) the chick came out of the shell. To see the efforts of the parents to feed it was curious. The second day, seeing that their efforts were in vain, I gave it some moistened bread, then I put it under the pigeon; so matters went on for three days, but the chicken wished to run about and I was obliged to take it from its adopted parents."—Bull. Soc. Zool., No. 4, 1892.

A Nest Building Frog.—In your issue for May, 1889, page 383, you published a paper in reference to certain batrachian nests discovered by me at Nikko in Japan. This summer I was shown by Dr. Guenther, at the British Museum, a couple of similar structures, though very much smaller in size, preserved in alcohol, and which had been received by the Museum from Japan. One of them had been taken from a shrub growing in the mouth of a well. Dr. Guenther told me that this nest is referable to a species of Polypedates. Day before yesterday I received a letter from my friend, Dr. A. C. Good, who is at present conducting a series of explorations in German West Africa. I take the liberty of transcribing a portion of the letter as follows:

"I desire to write you of something I saw on my last trip. As we brushed against the bush, that frequently overhung our path, I several times noticed, now on my shoe, now on my knee, a white froth. I thought it belonged to some insect, but for a long time I only noticed the white foam-like substance when I had gotten past the bush from which I had brushed it.

"At length, however, I brushed off a large bunch of substance, and when I tried to brush it from my clothes I uncovered some small creatures which wiggled about in it and evidently made this froth-like matter their home. On closer examination I discovered, very much to my surprise, that they were tadpoles.

"Later on I found on the underside of a leaf, a mass of this white substance that had not been disturbed since it had been placed there by the mother frog. I take it for granted that these tadpoles produce

tree-frogs. The nest was about three inches long, by two or two and one-half inches wide, and nearly an inch in depth. In the inside and at the edges the frothy mass was quite white, and in consistency resembled the white of an egg after being thoroughly beaten. The lower face of the nest had taken on a yellowish tinge from long exposure. In this I found eggs, or semi-transparent jelly-like bodies as large as a small pea, which had already some power of motion, and on a few of which the tail was just beginning to take form. In another nest I found similar eggs just developing and also well-developed tadpoles. These last were about one-eighth of an inch in length and had tails one-half of an inch long. They seemed to move with difficulty through the mass.

"I wonder whether this froth is at once home and food to them, but am unable to say. These nests are frequent everywhere except near the coast. I saw none nearer than ten miles from the beach.

"I remember your saying something about finding tadpoles in trees in Japan, and I have the impression that you published something on the subject. If so this will be of interest to you."

Whether the creatures, the young of which Dr. Good found in this frothy mass were the tadpoles of *Chiromantis guineënsis,* to which a similar habit is ascribed by Bucholtz, of course I cannot say.—W. J. Holland, Chancellor Western University of Pennsylvania.

Horse "Human Nature."—My son writes from a Wyoming ranch that a blind bay mare is ostentatiously protected by a black mare, the two having been raised together.

The blind horse would suffer greatly for feed, water, and from herd interference if the black were not constantly on guard. The latter watches the bay and grazes in a circle about her, keeping other horses at a distance by kicks and bites if necessary, selecting good grazing spots and watering places.

The guardian is rewarded with occasional kicks and other human-like evidences of gratitude.—S. V. Clevenger.

ARCHÆOLOGY AND ETHNOLOGY.

Legendary Evolution of the Navajo Indians.[1]—The Navajos once lived in a world below this earth. The tribe had twelve chiefs, and the chief had four wives. This head chief arose early in the morning and commanded his people to go to work. One morning he failed to arise. The third morning he failed to arise. The fourth morning he made no appearance. On the fifth morning the Navajos became uneasy, and went to find their chief. The other eleven chiefs wondered what became of him, and when they found him they learned that his oldest squaw had left him, and had married another man. The old chief grieved very much and refused to be comforted.

In a short time the squaw came in and said, "I have left you because I have ceased to love you. I can make my own living, and you can make yours." So they had a row.

This woman was chief of the women of the tribe.

Then the squaw called all of the women to council and said, "Let us part from the men!" So the women said, "Take all the men, boys, and male babies and cross the large river.[2] Burn logs out to make the canoes, and stay over there four years."

They gave the male children into the hands of some hermaphrodites, who raised them on the brains of wild sheep and deer.

The men sailed across the large river, planted large fields of corn, and raised immense crops. The first year the women raised a fair crop; the second year they raised less; the third year they had hardly enough to eat; and the fourth year was a complete failure.

The women became discontented, and were in a starving condition. Some of them ran into the river and were drowned.

[1]These legends were collected by the writer while employed in the Indian service at the Navajo Indian agency. They were related by Tsĕ-dĭ-ăhl-hă'-ŭn-bĕ-gĕh, or Rocking Sun, the great Lightning Medicine-Man of the Navajos. These legends were carefully interpreted, and are given word for word as they were related.

[2]The "Happy Hunting-grounds" of the Navajo Indians are represented as a land full of forests and lakes which abound in various kinds of game and fish. Flowing through the center of this land is a huge river which separates the braves and pretty maidens from the inferior members of the tribe and the old women.

So the women begged the men to come back to them. The woman-chief admitted that she had done wrong, that the women could not make their living, and that the men could not make their living.

Then the young chiefs held a council and said, "Let us go back to the women in four days, or they will die." So in four days they went back to the women, and had a feast of deer meat and love-making.

While they were having a good time the Coyote picked a young whale out of the water and hid it under his blanket. On the fourth morning after this, when they awoke, they saw a large blue wave of something coming from the east. The old chief sent an Indian to see what it was. The Indian returned and said that it was water. They looked to the north and saw a big white wave coming. The chief sent an Indian to see what it was. The Indian returned and said, "It is water." They looked to the west and saw a black wave coming. The chief sent an Indian to see what it was. The Indian returned and said, "It is water." Then they looked to the south and saw a green wave coming. The chief sent an Indian to see what it was. The Indian returned and said, "It is water." Then the chief called the tribe to council and said, "Something is wrong, we all will be drowned."

At that time the Navajos were animals and had squirrel blood in them. So the White Squirrel planted a pine tree; the Gray Squirrel planted a rattoon tree; and the Turkey planted a pipe-stem reed. The Navajos all ran into this reed and began climbing up on the inside. The reed grew very fast, even faster than they climbed. The water began rising higher and higher, and followed close to their heels. The Coyote was among them. The Badger went up first, making way for the rest with his paws. The Badger consoled the rest by saying, "I am very near the top of the earth." In getting his feet muddy his legs and feet have remained black from that time. The Turkey came up last, and the foam of the water touching its tail caused its tail-feathers to be tipped with white from that time.

Finally they came up through a lake, and they knew they had reached the top of the earth.

The Badger looked out and said, "I see a big Water Animal and some Big Men who are very mean." Then they sent the Locust out to see what kind of an earth this was. A big White Bird came from the north, met the Locust and said, "Things like you are not to be seen here!" Then the Locust replied, "We will see about this." A Yellow Bird came from the west, a Black Bird came from the south, and a Blue Bird came from the east, and they all said, "Things like you are not

to be seen here." But the Locust said, "We will see about that. If you will do as I do you may have this land; but if you do not do as I do I will beat you." The Locust had two arrows. He stuck one of them up through his body and the other one down his mouth. Then he took the two arrows and crossed them through his heart. He next threw the arrows at the White Bird and said, "If you do not do as I have done I will beat you." The White Bird took the arrows and pretended to do these things, but he only ran the arrows through his feathers.

There was so much water that the Locust could not bring his companions up out of the reed. So he took a mountain-sheep's horn and broke the land to the north and to the south and to the west and to the east, and the water all ran off. The Locust then went back and brought his companions out of the hole which the Badger had made. But the water still followed them up through this hole.

Then the chief said, "Some one has been playing a trick." He said to the Coyote, "You are always up to some meanness! What have you under your blanket?" The Coyote opened his blanket, showed the young whale to the chief, and then dropped it down this hole. The water immediately went back down the reed into the river. They all came out, but could not walk because of so much mud. Then the chief prayed to the wind, and the wind dried the mud.

The Navajos were now changed to people, but they did not know what to plant. The Turkey flew up, and the first time he dropped some yellow corn; the second time he dropped some red corn; the third time he dropped blue corn; and the fourth time he dropped all kinds of corn.

The Navajos then made hŏ′-gäns (houses), and the women and children played in them while the men worked. Some of them made houses in the rocks.

The chief then said, "We will see if there will be any deaths up in this world. I will throw a big log into the water, and if it sinks, we will each one have to die; but if the log floats, we will never die."

Then the Coyote tied a string to a rock and said, "I will throw this into the water, and if it sinks we will each have to die, but if it comes up and floats, we will never die."

The chief then said to the Coyote, "You are always doing some mean trick!"

But the Coyote said, "I cannot help it. If the Navajos never die, we will always be the same; but if the Navajos die, we will all be

different. We all have children, and if none ever die, this earth will not hold us."

On the fourth morning, one of their number died. They all looked for this one, but they could not find him. Then they looked down this hole which they came out of a few days before, and they saw this man down there combing his hair. This man looked up and said:

"I am happy down here. In time, you all will be down here where I am." Then there was a famine, and about half of them died.

The Mysterious Maiden.

There was a little girl found at daylight one morning. The woman who found her claimed that she was the "Mysterious Maiden," and so another woman took her and raised her. This child soon grew to womanhood.

This maiden conceived from a piece of petrified wood and bore a Giant. She conceived from a feather and bore a Large Bird. Then she conceived from a horn and bore a Large Animal (something like a buffalo), which ate the Navajos. She next conceived from a berry and bore a Bear. She then rubbed herself against a rock. Behind this rock was a patch of berries. When the Navajos went to gather the berries, the rocks would crash together and kill them. The sides of the rocks were covered with blood. The maiden then conceived from a reed and bore a patch of reeds. If a Navajo went into these reeds, he never was seen again. She next conceived from a battle-axe, and bore an Old Hag who lived among the rocks. This Old Hag would moan and cry for some one to come and kill her. When a Navajo went to kill her, she would blow on the battle-axe and the axe would kill the Navajo. She then conceived from a hair, and bore an Animal Whose Hair Grew Fast to the Rocks. This Animal stood on the brow of a precipice. Over in a corner of his den were some beautiful arrows. This Animal would tell the Navajos to come and get those arrows, but when they went there he would kick them over this precipice, and his children, who lived down below him, would devour them. Next, this maiden conceived from the sand and bore a pair of Big Eyes. At night, those Eyes shone like a big fire, and they would hollow for people to come over there. Then the Eyes would pierce their hearts and kill them. She next conceived from an antelope-hoof and bore Twelve Antelopes, who used to destroy Navajos. Lastly, she conceived and bore two sons. The oldest boy was conceived from the sun, and the younger one from the water. These boys were going to kill all of

these animals which destroyed the Navajos, but the Navajos were nearly all killed before this time. These boys grew up to be very large, had bows and arrows, and they used to run off. One day these boys asked their mother who their father was. She replied "The cactus and the water." But the oldest boy said, "I do not believe this." Then the mother said, "The sun is your father, but he lives a long way off."

Origin of the Yáy'-Bĭ-Chy̆s.[3]

The father of the Red Yaybichy was the sun. The father of the White Yaybichy was the water. The Mysterious Maiden[4] conceived from the sun and bore the Red Yaybichy. She conceived from the water and bore the White Yaybichy.

This Mysterious Maiden was out picking up wood, and was going to put it on her back, when the sun came up to her, dressed in turquois, beads, feathers, and fine skins. He told this maiden to be by herself that night, and he would come to her.

The Mysterious Maiden went home and told her father what the sun had said. The sun came and talked with her, but she did not know it; but she heard a noise going out from the hogan (house) where she stayed. She saw this man (the sun) four days afterward, and told her father that this was the same man she saw while picking up the wood.

She saw the sun abusing himself at daylight, and this made fleas and mosquitos.

In four days, these two sons were born to the Mysterious Maiden, and in four days more, these sons went up to visit their father.

The younger son had a cedar bow, and the older son had a piñon bow. They started toward the east to see their father.

The Black Yaybichy met them there and told them to go back. He told them that there were oceans and cañons and deserts and cactus fields and great fires and great wolves and great snakes and great bears that would destroy them, and said, "Your father lives a long way off."

[3]For a description of the Yaybichy Dance of the Navajo Indians see pages 435-436 of the Annual Report of the Bureau of Ethnology for 1883-'84, by Dr. Washington Mathews, U. S. A., under the direction of Major J. W. Powell, director of U. S. Geological Survey.

The Yaybichy medicine-men are the leading medicine-men of the Navajo tribe, and play an important part in all their religious ceremonies and fetichistic mysteries.

[4]The same maiden referred to in the Legend of the Mysterious Maiden.

These boys[5] (the Red and White Yaybichys) went by a large ocean, and looked down into the valley, and saw the smoke coming out of the ground. Here lived an old Woman-spider. When the boys came up the Spider said, "Hallo, grand-children, where did you come from? People of your class never come here! This place is not for you!"

"Our mother told us to go to see our father, the sun," said the boys.

"But your father lives a long way off, and he is not a good man. He will kill you with sweat-houses and red-hot irons."

Then this old Woman-spider gave them each a white feather, and told them it would be a Spirit to guide and defend them. Then she said, "Stop here to-night with me."

The boys said, "We can not get through that hole in the ground."

Then the old Woman-spider blew into the hole and it became larger. She then vomited, and gave them (the boys) their suppers.

The sun was now straight over their heads. The boys told the old Woman-spider that they wanted to get as far as they could before sundown.

The old Woman-spider was a spirit; so she pulled the sun down with a net and then told the boys that it was now sundown. The boys stayed all night, and they grew to manhood during that night.

The Black Yaybichy met them again, and told them that they would reach their destination about noon that day, and that their father would come to them at that place at night.

At noon that day they saw a big house and started to go in. Two big bears met them and snarled, but the boys said, "We are going to to see our father." Then the bears lay down and the boys passed over them. They next met two large, vicious snakes. The snakes rattled and hissed, but the boys said, "We are going to see our father." Then the snakes lay down and the boys passed over them. They next met two big lightnings and thunders. These stopped the boys, but the boys said, "We are going to see our father." Then the lightning lay down and the boys passed over it. They next met a number of little snakes of various kinds. The boys said, "We are going to see our father." Then the snakes lay down and the boys passed over them. They next met the sun's young wife. The boys said to her, "We are going to see our father." The young wife replied, "What are you doing here? Boys like you and people of your class are not allowed here." But the boys replied, "The sun is our father." Then the young wife wrapped them up in a white cloud that pointed toward the north. She also made a black cloud that pointed toward the east; a yellow

[5]The boys referred to in the Legend of the Mysterious Maiden.

cloud that pointed toward the south, and a red cloud that pointed toward the west. It was now pretty near night (sundown).

The sun had two children by this young wife, a girl and a boy.

The boy spoke and said, "I hear my father coming home, for I hear the white gourd rattle."

The girl spoke and said, "My father is coming, for I hear the blue gourd rattle." Then the boy said, "My father is coming home, for I hear the ivory gourd rattle." The girl spoke and said, "My father is coming close, for I hear the turquois gourd rattle."

At that moment the father came, making a fearful noise rattling the irons on his body.

The sun demanded of his young wife who those two young men were that he saw come into the house, but did not see go out again.

The wife replied, "You think you are pretty cunning. You told me that you had no wife but me. These young men claim to be your sons."

At this the sun became angry and rattled his gourds, and the earth began to tremble, the lightning flashed, the bears roared, and the snakes rattled and hissed. The sun then demanded where the two young men were, but the wife made no answer. He demanded this again, but no answer. He then demanded the fourth time, but still the wife refused to answer. Then the sun went to the cloud in the east, and knocked that down; but no one fell out of it. He went to the cloud in the west, and knocked that down; but no one fell out of it. He went to the cloud in the south, and knocked that down; but no one fell out of it. He went to the cloud in the north and knocked that down, and the boys fell out of it and stood before him.

All at once four sharp irons, corresponding to the four clouds, pointed toward the boys. There was a white iron from the north, a black iron from the east, a yellow iron from the south, and a red one from the west. The sun threw the boys violently against these irons, the north one first, then the east one, then the south one, and then the west one, but this white feather which the old Woman-spider gave them would let them down easy; so they remained unhurt.

The sun became angry and said, "I will find out if you are my children. If you withstand my test you are my children." Then a spirit descended and stood on each of their ears, and told the boys how to answer the sun's questions. It said, "Tell him he is your father." Then the sun took a huge turquois hammer and tried to mash the boys, but the feathers made the turquois hammer come down easy. The sun

then made the boys smoke some poison in first, a turquois pipe, and second, in an ivory pipe. He did this the second time, and still the boys were unhurt.

The sun said to his servants "Make a sweat-house and put four irons in it, one of the irons shall be white, one blue, one yellow, and one black, and make the house boiling hot."

Just as the boys started to go into the sweat-house a Gopher came up through the ground and told the boys to crawl into his hole. The hole was inside of the sweat-house.[6]

The Gopher said "If you stay in there the sun will throw water on the irons and the irons will break and kill you." So the boys went into the Gopher's hole. The Gopher then said, "If your father asks you if you are warm you go out of the hole and say, yes. You can thus fool him. He will throw the water, but you will be safe in this hole. He will then be through with you."

The sun placed a blanket over the mouth of the sweat-house and did as the Gopher had said. When the sun looked in he saw the boys sitting there unhurt. Then he kissed the boys and told them that they were his sons, and that they had gone through with all of the forms that could kill them. The sun then took the boys home with him and made his other son and daughter shake hands with them.

The young wife was then in a good humor, and dressed up her step-sons. One of them she painted red, with white streaks down his back, representing the lightning; the other one she painted white.

The sun then asked the boys what they wanted as a gift. The Spirits on their ears said, "do not answer him until he asks you another question." The father took them through a large iron gate to the east and showed them fine horses of all colors. The father said, "Boys, do you want these?" The Spirit said, "Tell him no." Then he opened a large iron gate to the north and showed them some fine sheep, and said, "Do you want these?" The Spirit said, "Tell him no." He next opened a large iron gate to the west and showed them some fine goats, and said, "Do you want these?" The Spirit said, "Tell him no." He then opened a large iron gate to the south and

[6]The Navajo Indians have sweat-houses at the present day. The house is made in a hemispherical form. Its first roof consists of poles, the second one is stones, and the third one is dirt. A hole is left in one side for ingress and egress. The house is usually located in close proximity to some stream or pond, and is used for medical purposes. Rocks are heated and thrown into the sweat-house and water is thrown on the heated rocks, causing steam to fill the apartment. The patient now goes into the sweat-house and covers the door with a blanket. After a time he comes out and plunges into the adjoining lake or river. This process is often repeated in winter.

showed them deer, buffalo, antelope and all kinds of game, and said, "Do you want these?" The Spirit said, "Tell him no." The father then brought the boys home, and said, "My children, what can I do for you?"

The boys looked and saw four lightning arrows and a huge bow hanging on the wall. The spirit said, "Tell him that you want these; that some animals, a Huge Giant, Twelve Antelope, a Huge Bird, an Animal Whose Hair Grew Fast to the Rock, are eating all the Navajos. Those arrows will kill them."

The sun replied, "The Giant[7] is my son and your brother, but if he is eating the Navajos you have my permission to kill him. He has no right to live. I will take you and go to-morrow morning."

On the following morning they started, and came to Sanmateo Mountain[8] about noon. The sun said, "Boys, where did you start from?" The Spirit said, "Tell him that it was from here; that here is where the Big Giant was." Then the sun let the lightning down, and the boys climbed down the lightning to a big spring at the foot of the mountains.

The Giant drank the water from the spring, and then lay down on a rock to rest. He did this the second time and the third time and the fourth time. As he turned his face toward the north the boys saw him lying on the rock. The Giant turned his face toward the east, and they could see his shoulders. He turned his face to the south, and they could see his waist. He turned his face to the west, and they could see his whole body.

The Giant now saw the boys and said, "Will not they make fine eating?" The Spirit said, "Tell him that he will make fine eating." The giant then flew in a rage and threw an iron boomerang at the head of the older boy. The Spirit said, "Stoop low, for he is throwing at your head." The Giant then threw one at his middle; the Spirit said, "Jump to the right or he will hit you." He next threw one very low, and the Spirit said, "Jump high, for he is going to throw it low."

The sun then appeared and said, "He is my son and I will have the first chance at him." Then the sun struck him with the lightning. The Giant fell to the earth and grew weak because he lost his blood.

[7]The same giant referred to in the Legend of the Mysterious Maiden.

[8]Sanmateo Mountain, or Mt. Taylor, is about forty miles from Fort Wingate, New Mexico. It seems to be the seat of nearly all the gods and demons of which the Navajo mythology is so replete. Dr. Mathews refers to it several times in his "Mountain Chant," found in the annual report of the Bureau of Ethnology, 1883–'84, J. W. Powell, Director.

The black rocks (igneous rocks) are his blood, and the petrified wood is his bones. The Spirit then said, "Do not let his blood run together, or he will get up again." His blood ran down the hill.

The boys then shot him with the four arrows which their father had given them, and killed him. The younger boy picked up the iron boomerangs and kept them. The younger boy was given the turquois gourd from his father.

They then saw these animals—the Buffalo, the Twelve Antelope, the Large Bird, and the Animal Whose Hair Grew Fast to the Rocks over in a little valley. They shook this turquois gourd at these animals and the animals all died.

The boys then went to the Cañon de Shelley[9] and went into one of the cliff-dwellings, known as the "White House," and disappeared, forever to remain as Yaybichys.

The Mission of the Yaybichys.

A man was once struck by lightning and knocked all to pieces. The Yaybichys came and sang over him and brought him to life again. The White Yaybichy was the first one who came. This one went over his body from east to west, from west to east, from north to south, and from south to north, and had four songs. This one picked up his meat.

The Black Yaybichy did the same as the white one.

The Red Yaybichy came, and when the man came partly to life he came from the east, and had a gourd in his hand, and made a noise like lightning. He came from the south and made another queer noise. Then he came from the west, and then from the north, and shook the gourd[10] over the dead man's head.

The gourd represents the noise of the lightning when it strikes a person.

The White Yabichy took the man home, after he got alive, and showed him all these medicine things, and how he worshiped them.

[9]Pronounced de Shäy. It is a beautiful little cañon situated about fifty miles from Fort Defiance, Arizona Territory. It contains many cliff dwellings, among which is the one known as the "White House," (because of its whitened walls) which is visited by numerous adventurers every summer. Most of the walls remain at the present day. There are now twenty-six Yaybichys in the Navajo tribe, including the sun and these two boys.

[10]The turquois gourd referred to in the Origin of the Yaybichys. The medicine-men of to-day seem to have unlimited faith in the turquois gourd.

This Yaybichy took him to Sanmateo Mountain and told him these things. He told him that a thousand years from this time the people would follow the teachings of the Yaybichys, that his son and his son's son through a period of a thousand years would be able to bring people back to life.

Then the Red Yaybichy took this man to Sanmateo Mountain and shook the gourd over him and told him how to wave the gourd over the dead man, from east to west (from sunrise to sunset), and from north to south. Then this man came back into the Navajo tribe and showed them how to use the medicine things,[11] and he was a great medicine-man.

But when this man came back and the Navajos broke their arms and legs, then they used these same medicine things, and they got well. So that made the Navajos have confidence in the medicine-man and the medicine things.

When any one gets sick we rattle the gourd over him and he gets well.

These two Yaybichys, the red one, called Yä-nä′ Yä-zän, and the white one called Tō-wäzh-zhŭs-chĭ′-nĭ, were made on the top of Sanmateo Mountain.

There were some animals that ate the Navajos at that time, viz., a Bear, a Large Bird, a Huge Giant, and a Fierce Animal Whose Hair grew Fast to the Rocks, and which coaxed the people to pass that way, when he would kick them down over the rocks and then go down and eat them up.

There was another fierce animal which chased the Navajos, killed them, and devoured them.

The Red Yaybichy killed all these animals[12] off.

There was a sister who had twelve brothers. This sister became a bear and killed the twelve brothers. Then the White Yaybichy killed this sister.

The father of the Red Yaybichy was the sun. The father of the White Yaybichy was the water.—T. Stanton Van Vleet.

[11]The "medicine things" referred to are the things which are used by the Yaybichy medicine-men at the present day. They consist of five pieces, each one of which performs a specific duty in restoring the health of the patient. The medicine-men claim that these "medicine things" have been handed down from generation to generation since the origin of the Yaybichys.

[12]These are the animals to which the "Mysterious Maiden" gave birth. They seem to have a significant place in Navajo mythology, and find their way into a large number of their legends.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

New York Academy of Sciences.—At the meeting of the Biological Section, Nov. 14, Prof. H. F. Osborn was elected chairman, and Bashford Dean secretary. The papers of the evening were:

Arthur Hollick, On Additions to the Palæobotany of the Cretaceous of Staten Island. These include about forty species not previously recorded from eastern North America, although in part described as occurring in the cretaceous of Greenland and in the Laramie. About fifteen new species were recorded, representing *Populus, Platanus, Myrica, Kalmia, Acer* and *Williamsonia.* The fossils were in the main taken from fire-brick clay. H. F. Osborn, Report Upon a Collection of Mammals from the Cretaceous (Laramie). The multituberculates *Meniscoëssus* and *Ptilodus* were assigned to the Plagiaulacidæ, the former a probable ancestor of *Polymastodon.* The relations of these mammals were shown to be closer to Puerco than to upper Jurassic forms. Arthur Willey, On the Significance of the Pituitary Body, suggesting from studies on Ascidians and Amphioxus a primitive monorhinic condition in vertebrates. The nasal sac of Petromyzon is of secondary nature, as shown by development (Dohrn) and nerve supply, but the nose in the monorhinic ancestor of vertebrates was the pituitary body of existing forms, this being represented in Ascidia, as shown by Julin, by the sub-neural gland and its duct, and in Amphioxus by the so-called olfactory pit. The pituitary body is to the lateral nares what the pineal body is to lateral eyes.

Bashford Dean exhibited an entire *Ctadodus*, a unique specimen recently collected in the Cleveland shales. The tail is for the first time shown, and indicates historically the origin of the ray parts of this organ in modern elasmobranchs.

Nebraska Academy of Sciences.—The annual meeting was held December 26 and 27, at Lincoln. Prof. Bessey was Chairman and Prof. A. H. Van Vleet, of Peru, Secretary and Treasurer. The following papers were read:

Psychology a Science, Dr. D. R. Dungan; Evidences of two Premorainic Glacial Movements, Prof. G. D. Sweezey; Evolution of the Loup Rivers, Dr. L. E. Hicks; Some Notes on the Fringillidæ of Nebraska, D. A. Haggard; The Myriapoda of Nebraska, F. C. Kenyon; The Canyon Flora of Northwest Nebraska, A. F. Woods; Notes

on the Flora of the Black Hills of South Dakota, P. A. Rydberg; Notes on Nebraska Phosphates, H. E. Fulmer; Some Notes on Mineral Water from Odell, Nebraska, Rosa Bouton; Systems of Notation in Numbers, Dr. H. E. Hitchcock; The Flora of Long Pine Canyon, Julius Conklin; The Flora of the Sand Hills, Roscoe Pound; A New Miocene Rodent, Prof. E. H. Barbour; The Fishes of Nebraska, M. E. O'Brien; Descriptions of Some New Nebraska Orthoptera, L. Bruner; Catalogue of the Orthoptera of Nebraska, L. Bruner; Notes on the Composition of the Lincoln City Gas Supply, Prof. H. H. Nicholson; The Relationship of the Nebraska Flora to That of the Regions Further West, H. S. Clason; The Erysipheæ of Crete, W. H. Skinner; The Fresh-Water Algæ of Kearney County, Nebraska, Dr. H. Hapeman; Some Mexican Lichens, Prof. T. A. Williams.

Boston Society of Natural History.—November 16.—The following paper was read: The Origin of Drumlins, Mr. Warren Upham; Profs. Shaler and Davis also spoke on the Origin of Drumlins.

December 7.—The following papers were read: Some Indian Quarries in Arkansas, Mr. Leon S. Griswold; Notes on a New Order of Schizomycetes (Bacteria). Specimens were shown with both papers.

SAMUEL HENSHAW, *Secretary.*

The Biological Society of Washington.—November 19.—The following communications were read: On Certain Minute (parasitic?) Bodies Within the Red Blood Corpuscles, Dr. Theobald Smith; The Topographical Relations of the Excretory Canals of Cestodes, Dr. C. W. Stiles; A Walchia from New Mexico, Mr. David White; Some Entomological Factors in the Problem of Country Fences, Mr. F. M. Webster; Comparative Value of Plants in Determining Floral Zones, Mr. F. V. Coville.

December 3.—The following communications were read: The Cruise of the U. S. Fish Commission Steamer Albatross in Alaskan Waters in 1892, Prof. B. W. Evermann; Some New Grasses, Dr. George Vasey; On the Rediscovery of Certain Rare Plants, Mr. J. N. Rose; Exhibition of a Complete Series of the Large American Ground Squirrels of the Subgenus Otospermophilus, Dr. C. Hart Merriam; The Mathematics of Forest Growth, Dr. B. E. Fernow.

FREDERIC A. LUCAS, *Secretary.*

Anthropological Society of Washington.—November 15.—The following papers were read: Singular Copper Objects from

Ancient Mounds in Ohio, Mr. Warren K. Moorhead; Geographic Nomenclature of the District and Vicinity, a Symposium, Mr. James Mooney, Prof. Lester F. Ward, Mr. W. H. Holmes, Mr. W. Hallet Phillips, Mr. W. H. Babcock, and Dr. Frank Baker.

WESTON FLINT, *Secretary.*

SCIENTIFIC NEWS.

Prof. John S. Newberry, Professor of Geology in Columbia College, New York, died at New Haven, December 7. He was born at Windsor, Conn., in 1822, and was the descendant of an old and distinguished Puritan family. He was graduated from Western Reserve College in 1846, and from Cleveland Medical College in 1848. After two years' travel and study in Europe he established himself as a physician in Cleveland. He returned to his scientific studies, which had long been in abeyance, in 1855, when he accepted an appointment as acting assistant surgeon in the army, and accompanied, as surgeon and geologist, the expedition under Lieutenant R. S. Williamson, U. S. A., which explored the territory lying between San Francisco and the Columbia River. In 1857–'58 he was attached, in the same capacity, to the expedition under Lieutenant J. C. Ives, U. S. A., which made the first exploration of the Colorado River, one of the most important of the western territory surveys. Dr. Newberry, in 1859, participated in the exploration of the country bordering the upper Colorado and San Juan Rivers. During the war of the rebellion Dr. Newberry was a member of the United States Sanitary Commission, and directed its operations in the Valley of the Mississippi. In 1866 he was appointed professor of geology in the School of Mines, Columbia College. In 1869 he was appointed head of the reorganized Ohio Geological Survey, and under his direction the work was vigorously pushed to completion.

Prof. Newberry had probably seen more of the United States from a professional point of view than any other of our geologists. He will be best known from his work on fossil plants and fossil fishes. He was especially conscientious in his comparisons of American with European forms of extinct life that came under his observation. Personally he was of a rather impetuous temperament, whose strong friendships were offset by a spice of irascibility without malice. He will be greatly missed from his place in the scientific life of America.

Sir Richard Owen died December 18. He was born at Lancaster on July 20, 1804. He received his early education in his native town, and at the age of 20 he began a medical course in the University of Edinburgh. He completed his studies in London and Paris medical schools.

When 30 years old he was appointed to the chair of comparative anatomy at St. Bartholomew's Hospital, and two years later he succeeded Sir Charles Bell as Professor of Anatomy and Physiology in the College of Surgeons. He held the latter place for twenty years, leaving it only to take charge of the Department of Natural History in the British Museum.

He had the Cross of the Legion of Honor, was a Chevalier of the Prussian Order of Merit, and was one of the eight foreign associates of the French Institute. He was created a commander of the Bath in 1873, and subsequently was made K. C. B. Sir Richard Owen was the successor of Cuvier as the leader in the progressive advance of the science of comparative anatomy. He filled up many of the gaps unavoidably left by the great Frenchman, which he was enabled to do by the opening up of many parts of the world by British commercial and colonial enterprise. His contributions to paleontology are even more important, his researches having covered regions that Cuvier could not in his day reach. Antarctic paleontology was founded by him, for South America, South Africa and Australia yielded their treasures to him first of all. Besides being an accurate observer and describer he was a good systematist, many of the current terms of zoology having originated with him. In generalizations of a higher grade he was not active; the doctrine of evolution having arrived rather late to get that attention from him which its earlier advent would have secured.

Owen was a tall and stalwart man of spare habit. He was characterized by a mental and physical tenacity, which was exhibited in his psychic structure in the great difficulty he experienced in changing an opinion he had once formed. He was fond of diplomacy, and could dissect an adversary crosswise of the grain in the most bland and sympathetic manner imaginable.

Prof. J. T. Rothrock has resigned from the faculty of the University of Pennsylvania, and will occupy the position of Secretary of the Forestry Commission of Pennsylvania.

What is an Acquired Character?—A Correction.—In the December number of The Naturalist, page 1010, occurs about as

unfortunate an error in proof-reading as could have been made. The sentence "*I must confess my inability to see why this variation is not qualitative as well,*" is put in quotation marks, as if it were credited to *Weismann.* The sentence is my own, and would doubtless be indignantly repudiated by the great apostle of Neo-Darwinism, as it is flatly Neo-Lamarckian in fact.

In explanation I will simply add that I did not read the proof. The original manuscript in my possession is correct, although I am not positive that the typewritten copy forwarded to THE NATURALIST is not at fault.—C. C. NUTTING.

RECORD OF NORTH AMERICAN ZOOLOGY.

(*Continued from Vol. XXVI, p.* 798.)

GROTE, A. R.—[Validity of] *Halisidota trigona*. Can. Ent., xxiii, 109, 1891.

GROTE, A. R.—Note on Graphiphora Hubn. Can. Ent., xxiii, 101, 1891.

GROTE, A. R.—The male genitalia and the subdivisions of Agrotis. Can. Ent., xxiii, 147, 1891.

GROTE, A. R.—*Halisidota trigona*. Can. Ent., xxiii, 201, 1891.—Validity of.

GROTE, A. R.—On *Catocala flebilis* and *C. fratercula*. Can. Ent. xxiii, 281, 1891.

GROTE, A. R.—*Agrotis subgothica*. Can. Ent., xxiii, 202, 1891.—Reply to Tutt.

GROTE, A. R.—An explanation. Can. Ent., xxiv, 17, 1892.—Reply to certain criticisms of J. B. Smith, as to arrangement of Heterocera.

GROTE, A. R.—Remarks on Prof. John B. Smith's revision of the genus Agrotis. Can. Ent., xxiii 45, 1891.

HOWARD, L. O.—The larger corn stalk borer. Insect Life, iv, 95, 1891.—*Diatræa saccharalis*.

HUDSON, G. H.—A new species of Cerura. Can. Ent., xxiii, 197, 1891.

HULST, G. D.—Prof. J. B. Smith's List of Lepidoptera. Can. Ent., xxiv, 74, 1892.

HULST, G. D.—New species of Pyaalidæ. Can. Ent., xxiv, 59, 1892.—15 sp., Ocala and Chipeta, nn. gg.

KELLICOTT, D. S.—Notes on two borers injurious to the Mountain Ash.—*Podoseiia syringæ, Zeuzophora semifuneralis*.

KELLICOTT, D. S.—Notes on the Ægeridæ of Central Ohio. Can. Ent., xxiv, 42, 1892.

KELLICOTT, D. S.—[Tortricid feeding on *Silphium perfoliatum*]. Can. Ent., xxiii, 218, 1891.

LINTNER, J. A.—[An onion pest, *Agrotis ypsilon*]. Can. Ent., xxiii, 220, 1891.

LINTNER, J. A.—On the eye-spotted bud-moth (*Tmetocera ocellaria*), in Western New York. Can. Ent., xxiii, 231, 1891.

LINTNER, J. A.—On some of our Orgyias. Can. Ent., xxiii, 232 1891.

LYMAN, H. H.—*Pamphila manitoba* (Scud.) and its varieties. 22 Rep. Ent. Socy. Ontario, 1891, 27. Can. Ent. xxiv, 57, 1892.

MOFFATT, J. A.—A microscopical examination of an unexpanded wing of *Callosamia promethea.* 22 An. Rep. Entom. Socy. Canada, 32, 1891.

MOFFATT, J. A.—Additions to the Canadian list of Microlepidoptera. Can. Ent., xxiii, 167, 1891.

MOFFATT, J. A.—*Melitta phaeton* [in Ontario]. Can. Ent., xxiv, 18, 1892.

MOFFATT, J. H.—*Petrophora silaciata.* Can. Ent., xxiv, 18, 1892. —Distribution and varieties.

NEUMÖGEN, B.—About Pseudohazis and its variations. Can. Ent., xxiii, 145, 1891.

OSBORN, H. and GOSSARD, H. A.—The clover-seed caterpillar (*Grapholitha interstinctana* Clem.). 22 Rep. Ent. Soc. Ontario, 74, 1891. Insect Life, iv, 56, 1891.

OSBORN, H.—*Asopia farinalis* as a clover pest. Can. Ent., xxiii, 283, 1891.

PACKARD, A. S.—Notes on some points in the external structure and phylogemy of Lepidopterous larvæ. Proc. B. S. N. H., xxv, 82, 1891.

PATTON, W. H.—Aphidivorous habits of *Teniseca tarquinius* (Fabr.) Grote. Can. Ent., xxviii, 66, 1892.

RILEY, C. V.—A new herbarium pest. Insect Life, iv, 108, 1891.—*Carphoxera ptelearia* n. g. and sp. Geometridæ.

SMITH, J. B.—Contributions toward a monograph of the Noctuidæ of Temperate North America.—Revision of Homohadena, Grote. Proc. U. S. Nat. Mus., xiii, 397, 1891.—*H. deserta* nov.

SMITH, J. B.—Contributions, etc., Revision of the species of Hadena referable to Xylophasia and Luperina, l. c, p. 407, 1891.—*X. cogitata, alticola, nigrior, antennata, centralis,* are new.

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SMITH, J. B.—*Limenitis arthemis,* etc. Can. Ent., xxiii, 104, 1891.

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SMITH, J. B.—*Halisidota trigona* Grt. Can. Ent., xxiii, 158, 1891.

SMITH, J. B.—Prof. J. B. Smith's List of Lepidoptera. Can. Ent., xxiv, 103, 1892—Reply to H. G. Dyar.

TOWNSEND, C.. H. T.—*Chilo saccharalis* in New Mexico. Insect Life, iv, 24, 1891. 22 Rep. Ent. Soc. Ontario, 50, 1891.

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